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HIFI NEWS

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VOLUME 36 No 2

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This new control unit for model trains is very easy to build, yet offers very realistic "simulated inertia" operation. Read all about it in the story on page 46.

On the cover

A customer discusses the merits of a product with one of the sales staff at the Dee Why branch of Kitsets Australia Pty Ltd. With branches in five states, this firm is the largest electronics kit, components and hifi component supplier in Australia. A complimentary copy of their new catalogue is inside this issue.

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PHILIPS

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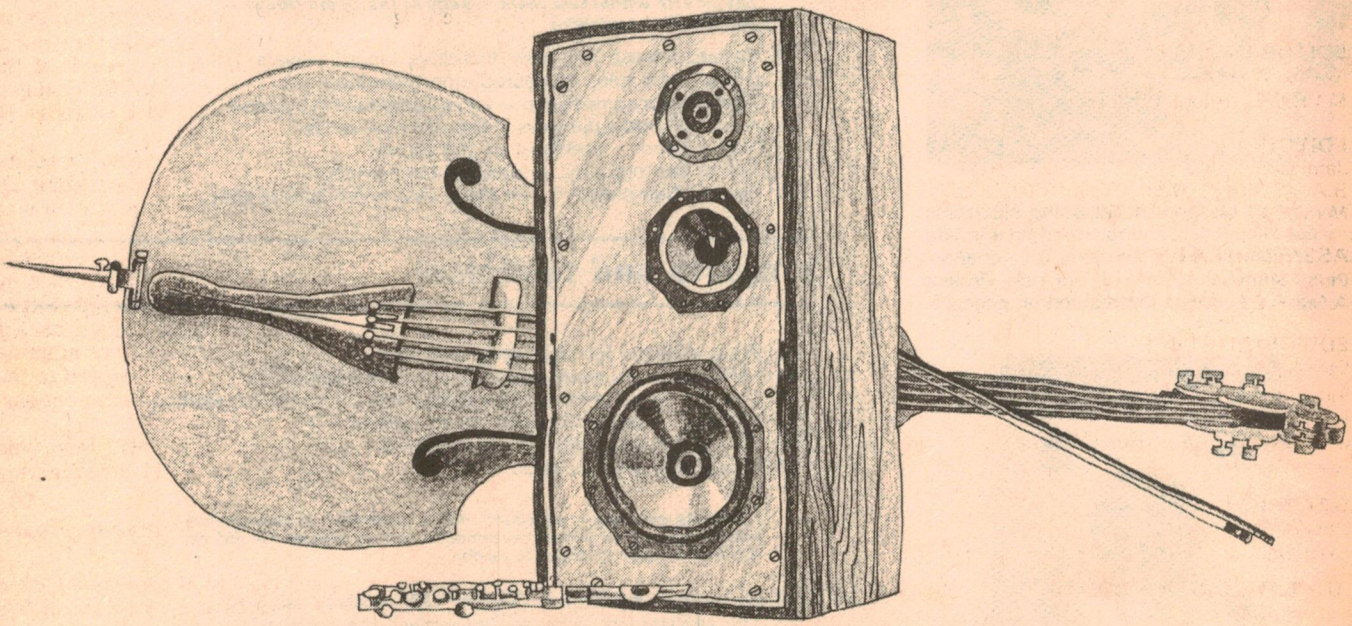

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Editorial Viewpoint

FM broadcasting on VHF after all

As I write this, it has just been announced that the Government has approved the recommendations made by the McLean Inquiry into FM Broadcasting. It has been agreed that stage one of the recommended program to establish FM broadcasting on the VHF band will begin immediately, so that each capital city should have two or three FM stations by mid 1976.

The thing which intrigues me about this development is that it was almost unthinkable as recently as 18 months ago. The political climate was then rather different, and the possibility of changing spectrum allocations made years earlier with regard to VHF television and aircraft DME seemed very remote. Those persistent souls who argued for FM broadcasting on the VHF band seemed to be flogging a long-dead horse; if Australia wanted FM it would be forced to go it alone, on the UHF band.

But to quote a truism, things have changed somewhat. With both a change in government and an upturn in consumerism, it was perhaps inevitable that many aspects of the FM broadcasting question would be re-evaluated. The result of the McLean Inquiry was almost a foregone conclusion, bearing in mind the changed circumstances and its relatively narrow terms of reference — to which I alluded in my November editorial.

Of course the attitudes and motivation behind any decision of this type do not really affect its correctness or otherwise. If a decision is the right one, the events leading up to it are largely irrelevant. And in this case I think the decision in favour of VHF was indeed in the best long term interests of Australians as a whole.

To be sure, it means that the Australian FM market will be open to overseas manufacturers, so that our own manufacturers won't have the protection afforded by either a high tariff barrier or a unique technical standard. And the proposed shift of TV stations out of channel 5 will involve considerable expense and inconvenience. But it seems likely that these penalties are far outweighed by the savings from aligning ourselves with other countries, not just in terms of FM itself but with regard to the whole of the VHF spectrum. Australia is ill equipped to go it alone in communications, least of all in the consumer area.

We at Electronics Australia welcome the decision in favour of VHF, then, and look forward to helping our readers gain maximum benefit from FM broadcasting when it commences.

—Jamieson Rowe

PRICE RISE: We sincerely regret that, owing to sharp rises in the cost of paper, production and other services, it has been necessary to increase the cover price of EA in Australia. We feel that, in an inflationary situation, it is more realistic to maintain and, if possible, increase the quality of the journal, rather than suffer the consequences of endless "economies."

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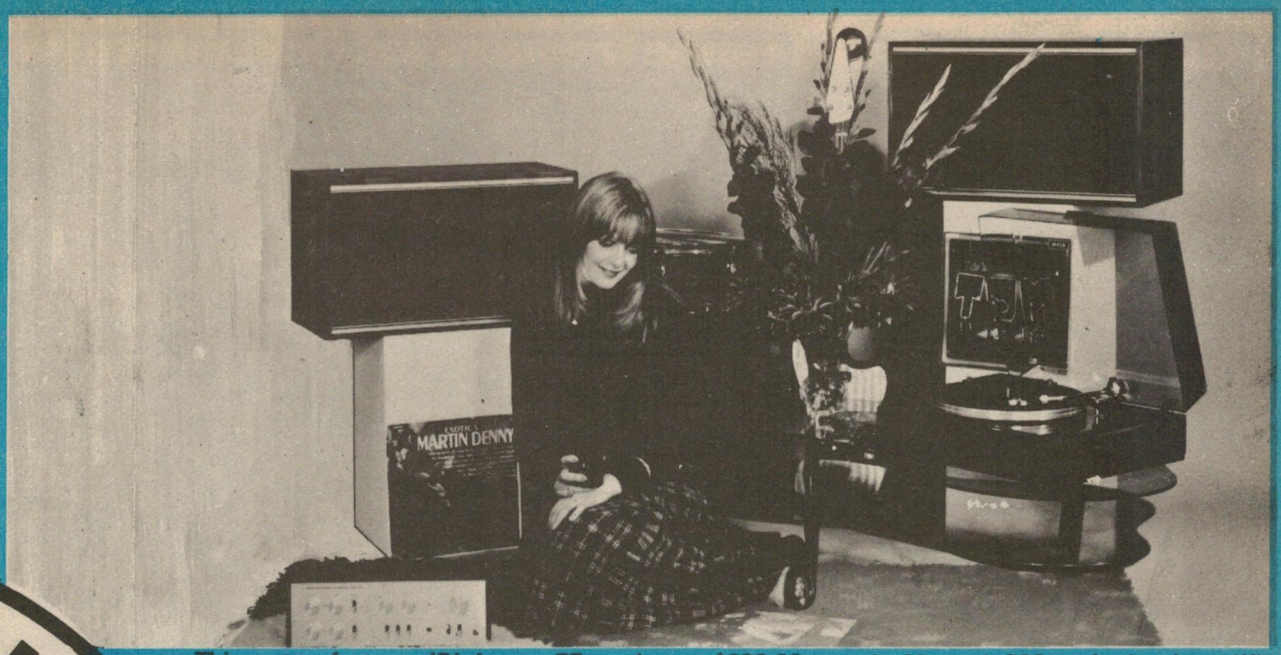

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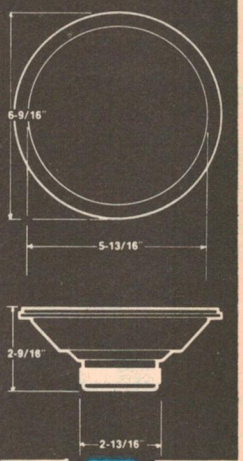

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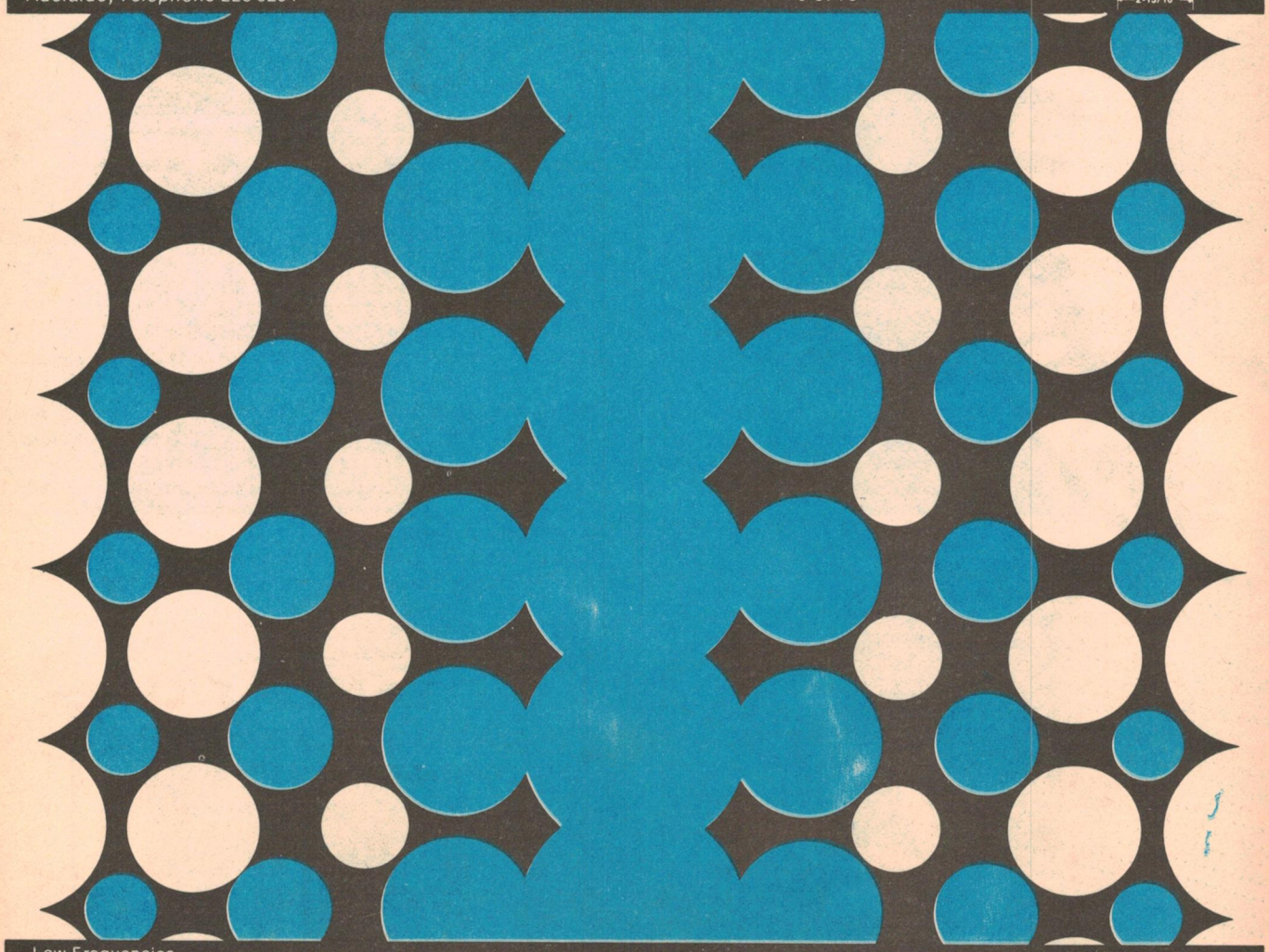

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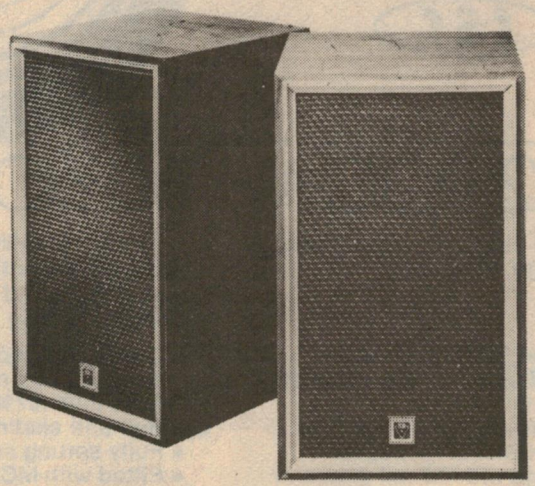

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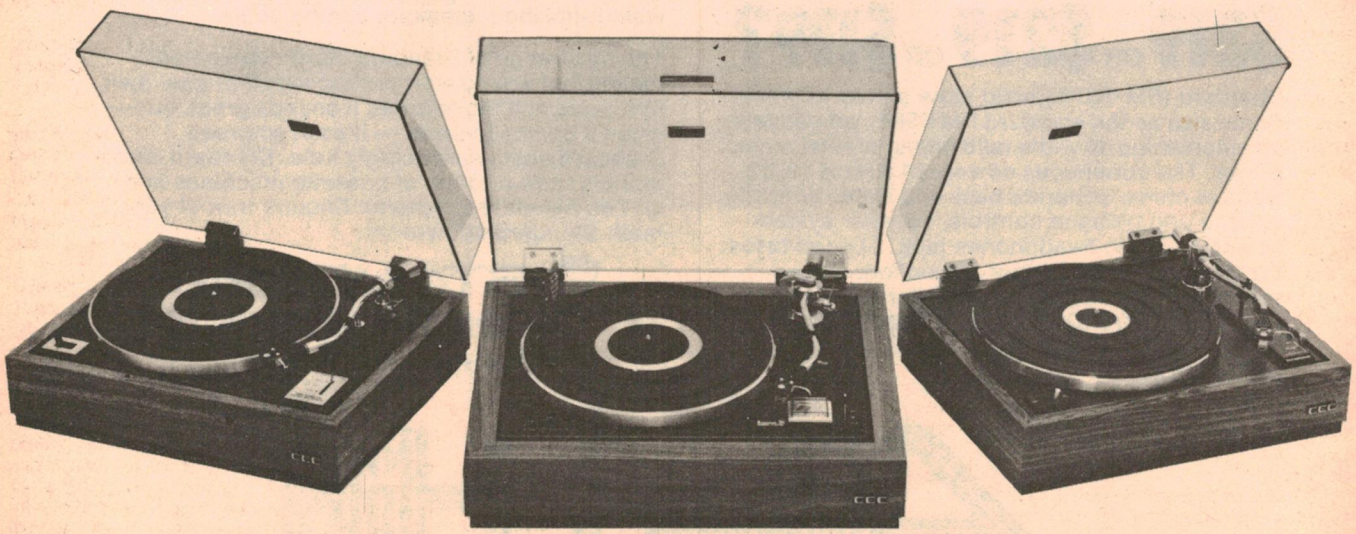

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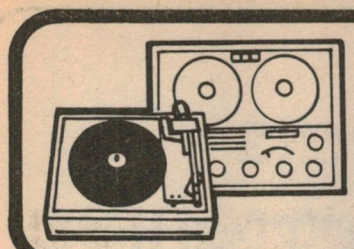


Hi Fi News

FM on VHF within two years

UHF / FM received a knock-out blow with the release of the report of the Independent Inquiry into FM broadcasting. It has been accepted by the Australian Government for the basis of a service to be initiated within the next two years, at most.

by DICK LEVINE

While it is probable that events would not have followed this course, had the previous Government remained in office, it is now unlikely to be altered whatever the complexion of the party on the Treasury benches. Parties and Parliament alike are glad to see an end to the argument.

It was this conflict within the Government which resulted in the independent inquiry being set up. The inquiry was conducted by a former director of engineering for the BBC, Sir Francis McLean, and an economist, Professor C. C. Renwick, who is director of the Hunter Valley Research Foundation.

Sir Francis currently is chairman of the Telecommunications Industry Standards Committee of the British Standards Institution.

The inquiry's report favoured VHF / FM on three major grounds: cost benefits, speed and ease of starting up the service, and conformance with international frequency allocations.

Cost of VHF receivers to the public for 90pc coverage would be $131 million, says the report, as compared to $338 million for UHF. The second figure includes additional aerials calculated at $15 each — a rather conservative amount. Cost of new aerials was not included in the VHF total, the assumption apparently being that existing TV aerials will be adequate.

Capital costs for equipment would be double for UHF. These were estimated at $45 million for VHF against $90 million for UHF.

The objections to UHF centred on the high cost, unpredictability and long lead time associated with development of a suitable alternative for the VHF pilot tone coding system for stereo broadcasts.

Of the VHF pilot tone system, the report says "There are good grounds for thinking that this system will be extensible for quadraphonic broadcasting if this be required."

The discussion of coding systems is a fairly good summary of the report's objections to UHF.

"We recognise that the various proposals for alternative coding systems based on communication industry practice could possibly give improved results in some respects. Development of such systems would take considerable time and the verification of acceptability by extensive field trials still more time. It is possible that such systems would be found either not capable of giving the required performance or of requiring an expensive receiver or possibly a receiver difficult to operate by the ordinary person. Verification of these factors would take considerable time; we were told approximately 2 years but we believe it could well be longer.

"Our assessment of the attractiveness of the proposals and the probability of success is such that we reached the conclusion that the delay and cost to investigate further would be greater than had been suggested. Moreover this work would tie up a very considerable effort by all concerned including the manufacturing industry. There would be a further effective delay by the probable reluctance of the public to accept readily a new system.

"Coverage on UHF would therefore not start before the date at which VHF could be approaching 85—90 percent coverage. The coverage characteristics of the VHF are such that 95 percent coverage should be achievable within about 7 years, and transmission could largely be carried out from existing TV sites.

"The characteristics of UHF are such that for a given number of transmitters the coverage is markedly less and many blind spots are to be expected. It seems doubtful whether as much as 90 percent coverage would be obtained within 7 years from the start of transmission, which itself could be 5 to 6 years from the date of the decision to proceed with the system. The work and cost involved to obtain 95 percent coverage would be very much greater.

"There is a risk that the development work on UHF, and a new coding system, which would occupy some two or three years, would reveal a basic unsuitability of the UHF band for radio usage.

"We were strengthened in this view by the opinions expressed by so many interests that the pilot tone system was entirely satisfactory for monophony and that the theoretical degradation towards the limit of the service area was in practice not an appreciable restriction on stereo reception.

RAPID ACCEPTANCE

"VHF stereo could earn rapid public acceptance from two years from the decision to proceed, whilst UHF would earn much slower acceptance (from, say 5 to 7 years from the decision) due to problems of incomplete penetration and public reluctance in the face of innovation."

The report recommends starting FM broadcasting as soon as possible (a few months) on the VHF bands, with a four-phase introduction scheme spanning 20 years.

It recommends a limited introductory service in some areas in the 92-94MHz space as soon as practicable, with regular service in that space within 2-2½ years.

This would be expanded to take in the 7MHz between 101 and 108MHz as Channel 5 services are gradually shifted to other frequencies. The frequencies between 92-94MHz and between 101 and 108MHz would be adequate for all requirements for at least 7 years after the start of the service.

Stations would initially be spaced 800kHz apart. The second phase would simply consist of allocating channels between the initial allocations, with only 400kHz spacing. This move would be dependent upon "expected improvements in transmitter aerial and receiver performance." This near-doubling of channels would provide sufficient service up to about 1985.

Assuming more space is needed after this, and that the long-term aim of vacating the international 88-108MHz band is still being pursued, things get more complicated.

Phase 3 includes shifting Channel 4 to a new-channel, to be called 9A. First the aeronautical DME services would be transferred to the 1000MHz band or

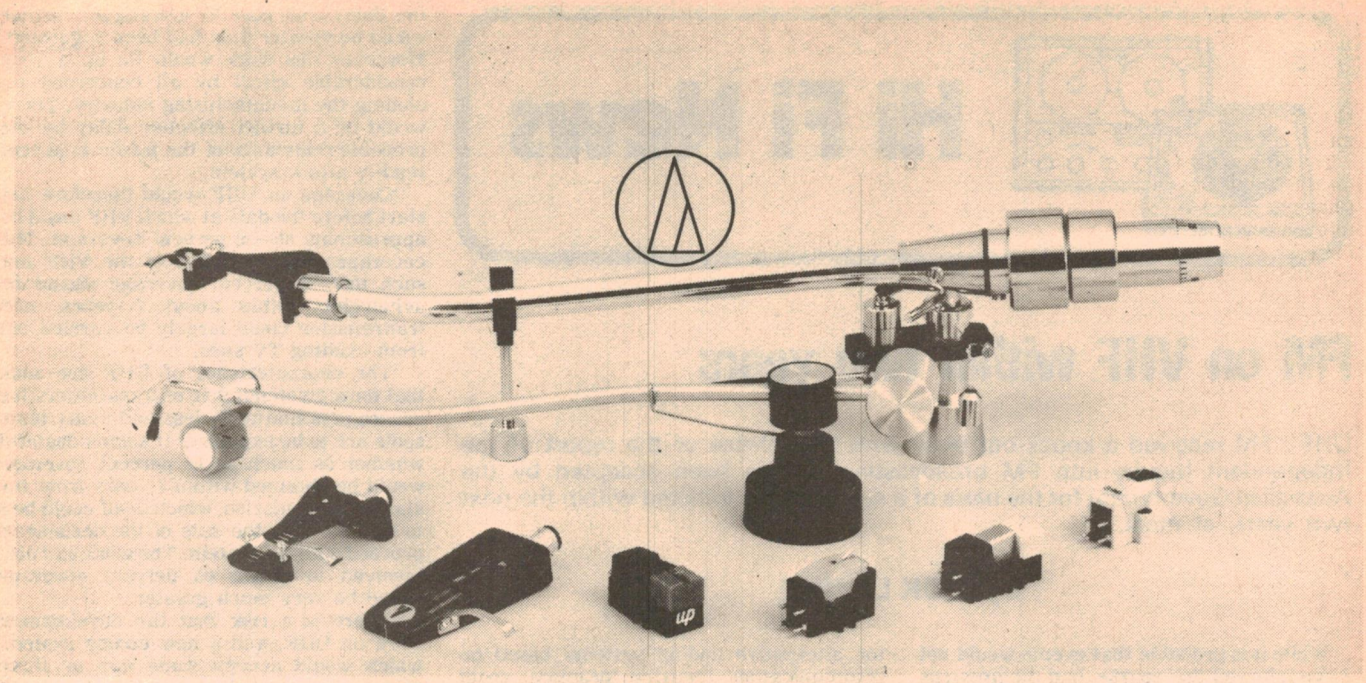
Suggested *Schedule to Free Channel 5 TV:

TAREE, NSW:	
Provide service Ch 6:	12 mths
Discontinue Ch 1:	15 mths
NEWCASTLE, NSW:	
Provide service Ch 1:	15 mths
Discontinue Ch 5:	21 mths
BUNBURY, WA:	
Provide service Ch ?:	15 mths
Discontinue Ch 5:	21 mths
TRANSLATORS:	
Provide other Ch	15 mths
Discontinue Ch 5:	21 mths

*From date of decision to implement change in each area.

Based on Fig 3 in the FM Inquiry report (March 1974), this table shows how the Authorities could go about freeing the existing TV channel 5. An overlap period of 3-6 months is envisaged, during which time viewers could have aerials modified, if need be, and tuners checked and adjusted. Channel 5 would be available for FM about two years after the decision to implement the change.

Dick Levine, formerly a member of EA staff, is now Editor of our associated industry journal "Electronics News."



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Type	VM	VM	VM	VM	VM	VM	DM	DM
Frequency Range (Hz)	20–35,000	20–40,000	20–40,000	10–40,000	10–41,000	10–45,000	20–20,000	10–25,000
Channel Balance (dB, at 1 kHz)	±0.5	±0.5	±0.5	±0.5	±0.5	±0.5	±1	±0.5
Channel Separation (dB, at 1 kHz)	30	30	30	30	30	30	28	30
Output Voltage (mV, at 1 kHz, 5 cm/sec. rms.)	4	4	4	5	4	2	4	4
Compliance (x 10^{-6} cm/dyne)	17 (AT-VM8) 20 (AT-VM8X)	26	27	24	28	28	22	25
Tracking Force (gram)	3.0–5.0 (AT-VM8) 2.0–4.0 (AT-VM8X)	1.0–2.0	1.0–2.0	0.8–2.2	0.5–2.0	0.5–2.0	1.0–2.5	0.8–2.0
Weight (gram)	6.5	6.5	6.5	6.0	6.7	6.7	7.5	7.5
Recommended Replacement Stylus	VM8–7D VM8–EL	VM3–5D	VM3–EL	AT35–5D AT35–EL	VM35–EL	VM35–FD	AT66–7D AT66–EL	AT21–5D AT21–EL

Specifications for AT-Tone Arms	AT-1005 II	AT-1007
Overall Length (mm)	323	327
Effective Length (mm)	240	240
Overhung (mm)	15	15
Maximum Tracking Error Angle	1° 30′	1° 30′
Tracking Force (gram)	0–3.0	0–2.5
Weight of Applicable Cartridges (gram)	5–24	5–24
Turntable Height (mm, approx. as measured at cartridge thickness of 18 mm)	30–57	25–85
Head Shell	Model S: weight 8.5 grams	Model UL: weight 6 grams
Vertical Bearing	Pivot Bearing	Pivot Bearing
Horizontal Bearing	Radial Ball Bearing	Radial Ball Bearing
Effective Mass (gram)	20 (with AT-VM35F)	13 (with AT-VM35F)
Remarks	Fitted with anti-skating mechanism and can be fitted with arm lift	Fitted with anti-skating mechanism and hydraulic arm lift

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elsewhere. This proposal has already been made.

Then Channels 10 and 11 would be moved up 1MHz and Channel 9A created between Channels 9 and 10. With Channel 4 moved into the new space, available channel space for FM would again be nearly doubled to provide adequate services up to 1995.

The last phase would drop Channel 3's frequency below 88MHz, adjacent to Channel 2. Fixed and mobile services between 70 and 85MHz would be displaced and shifted into UHF.

Channels available in any one transmitting area would depend on the number of high power stations allocated, but as a rough guide, Phase 1 would provide 26 channels, Phase 2, 42 channels, and after completion of Phases 3 and 4, a possible maximum of 50 channels would be available.

Interference problems were examined in some detail in the report, but it was concluded that they could be successfully dealt with by careful planning of the transmitter network, gradual transmitter power increases during initial phases of the plan, and a program of education and assistance to receiver servicemen.

The report also recommended tougher performance standards for future FM and TV receivers regarding rejection of unwanted frequencies and secondary radiation from local oscillators. It also recommended that all TV receivers in future be multiband, including UHF.

The ABCB has drawn attention to possible mutual interference problems between TV and VHF FM services. The new report envisages that FM services would have to be introduced gradually, in terms of number and power, and that tight controls may have to be enforced over performance of — and RF radiation from — new FM and TV receivers.

The Sydney / Newcastle / Wollongong area was chosen to illustrate how an initial system would possibly be allocated as it is considered to be the most difficult area to sort out.

In Sydney, one high power (50kW, 70 miles) station would be given to the ABC, four medium power (10kW, 35 miles) to commercial radio, two high power to community radio and three medium power to public access stations.

A 'community station' is defined as a station which is "primarily intended to serve larger geographic areas or whole communities, run by a licensee using his own financial and technical resources, but not for profit." Presumably this means music societies, educational organisations, etc.

A public access station is "a station in which the transmitter facilities are operated by a central body which leases the time on the station to approved applicants with special interests."

The other stations in the area show a similar distribution, but with medium and low power stations only, making a total for the whole broadcasting area of 3 high power, 14 medium power and 11 low power channels used. This leaves 8 channels in the area available for future expansion.

Sony at the Opera House

At about the time this issue was in transit between our printery and your local newsagent, Sony was making history at the Sydney Opera House, with the first major commercial exhibition to be staged in the new complex.

Sandra Lewis of Sony displays the world's smallest colour television receiver, a 5-inch portable. The Trinitron type of colour picture tube originally pioneered by Sony is being scaled up for full-sized console sets.

Under the name SATOH (Sony At The Opera House) the exhibition, from April 29 to May 5, was intended to underline the broad horizons of Sony in consumer electronics. Specifically mentioned in the promotional literature was the Sony effort in producing Japan's first tape recorder. More recent developments have included the electret capacitor microphone, the trinitron colour TV picture, tube, electronic desk calculators and a colour videocassette system.

Sony's connection with the Opera House is not a new one, although this is the company's first exhibition to be held there. The Charles Blackman painting, "Girl Listening to Music," was given to the Opera House by Mr Akio Morita, President and Co-Founder of the Sony Corporation. Mr Morita, when asked to summarise the aim of the Corporation, said it was "to educate the world." This was also the spirit of SATOH.

One of the main aims of the display was to explore the educational possibilities of video recording. Visitors were able to see the whole process of videotaping from a simulated studio, through to the final reproduction of video cassettes. A special one-day seminar, held as part of SATOH, was chaired by Mr Frank Watts, Director of Education for the ABC.

A wall of colour television receivers was featured at the exhibition. Excerpts from current television programs were shown in colour, as well as footage about the Opera House itself. Sony colour sets will be available in Australia in early 1975.

On display was the world's smallest colour television receiver, a miniature 5" type, which can also be operated from a car or boat battery. Chief Executive of Sony, Mr Phillip Jacoby, believes that popularity of this style of personal viewing will increase as education takes a more important place in television broadcasting.

Also on display was the largest colour TV tube made — a 27" model which has been specially imported for SATOH. As well, the latest developments in four-channel stereo were demonstrated in a walk-in quadraphonic sound room.

2Ch-4Ch JVC Cartridge from Hagemeyer

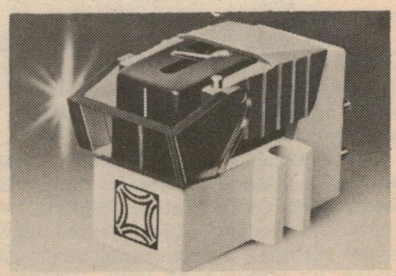
Listed among the new products from Hagemeyer (Australasia) BV is the JVC magnetic cartridge type 4MD-20X.

Fitted with a Shibata diamond stylus, the new cartridge is claimed to be completely compatible with the requirements of 4-channel "discrete" (CD-4) discs and those recorded to conventional 2-channel stereo standards including, of course, matrix quadraphonic.

Published specifications show the effective frequency response as being from 20-60,000Hz, with a channel separation greater than 30dB at 1kHz and 20dB at 30kHz. Output balance is given as 0.5dB.

Other figures include: output 2mV at 1kHz and 50mm / s; impedance 2.5k at 1kHz; stylus pressure 1.5 to 2gr; compliance 35 uDynes; load 47k — 100k.

A removeable assembly carries the stylus, attached to the tip of a cantilever arm, at the other end of which is a diminutive V-shaped magnet. Also attached to the assembly is a stylus guard, which protects the stylus when the head is not in use, flipping out of the way, when a record is to be played.



The new JVC 4MD-20X cartridge is claimed to be fully 2Ch / 4Ch compatible.

Approximate retail price for the cartridge, complete, is $55.00. (Further inquiries from Hagemeyer (Australasia) BV, 59 Anzac Pde, Kensington, NSW 2033.

HIFI NEWS

'75 sounds fantastic

13th ~ 17th August 1974
CENTREPOINT · SYDNEY

Plans are now well in hand for the "75 Sounds Fantastic" hifi exhibition announced in our February issue and referred to — rather prematurely — as the "75 Sounds Spectacular." Fantastic, Spectacular, what's the difference?

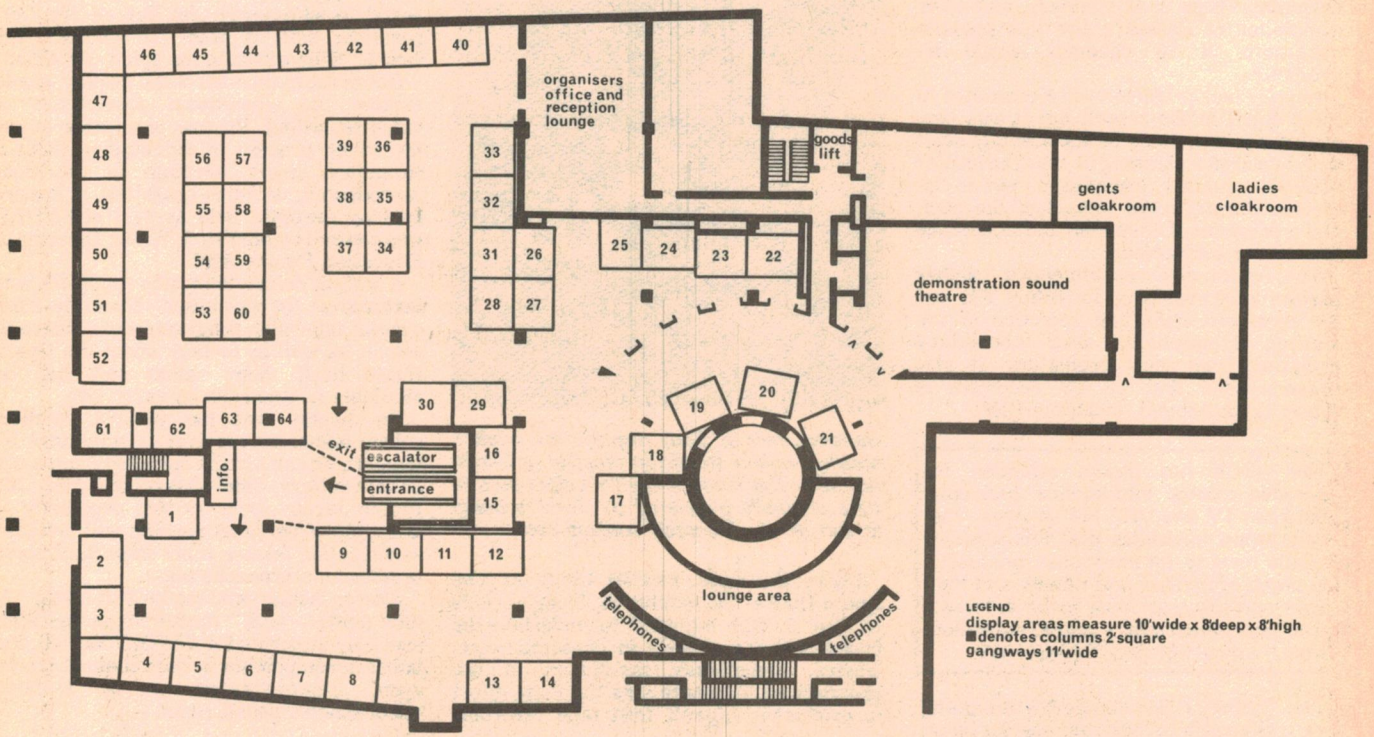
The exhibition will be held in the new Centrepoint complex, in the heart of the Sydney business area, and central to the major transport systems. Choice of the particular venue is in line with the basic purpose of making the exhibition accessible to the largest possible number of people — to the general public as well as to committed hifi enthusiasts.

The exhibition will be open each day August 13-17 inclusive, from 11 am to 9 pm.

A feature of the exhibition will be the fact that all stands will be in the one large auditorium area, as indicated in the provisional floor plan shown below. Visitors will be able to move from stand to stand without negotiating stairs or passageways and be able more easily to compare competitive products.

Another unusual feature is that no sound demonstrations will be permitted in the display area, except through headphones, and there will be no cash sales on the site. Purpose of this is to allow visitors to narrow down their preferences for equipment which seems to suit them, free from the pressures and the noise that so often characterise a hifi exhibition.

Listening sessions will be presented in the theatre, however, designed to show the public what modern sound equipment can give them, brand notwithstanding.



Yamaha scores in magazine review

Yamaha audio products have taken high honours in a magazine-sponsored review. The magazine was the Japanese journal of radio engineering. "Rajio Gijutsu," a monthly with a readership of 120,000.

In its December, 1973 issue, "Rajio Gijutsu" published the results of its "3rd Japan Stereo Components Grand Prix" — a technically-minded, music-oriented survey of 600 different stereo components conducted by a panel of eight well-known audio / music critics.

The products examined were divided into some eleven categories (covering cartridges, receivers, tuners, pre / main amplifiers, etc) often sub-divided into groups indicating price ranges.

In the speaker category, the eight panel members favoured the Yamaha Natural Sound Speaker System NS-690. Critic Shunsuke Wakabayashi noted that this 3-way, 3-speaker system with air-tight enclosure easily reproduced all highs with very sharp definition and added, "the design, also, is in a class of its own," citing the natural wood used and sturdy construction.

Six of the eight panel members gave the Yamaha CA-1000 and Technics SU-3500 joint top position in the pre / main amp category. One of the two members voting for entries other than the CA-1000 nevertheless said: "There's no doubt that the CA-1000, with its Class A / Class B flexibility, is indeed a rare amplifier of bold design concept."

Still another Yamaha product to win a top position in the final vote was the CR-400, sharing first prize in the receiver category with the Trio KR-2300. Audio critic and science fiction author Tetsuo Nagaoka said that the CR-400 receiver was no match for the (more expensive) CA-1000 amplifier but "its tonal quality is very unreceiverish, more like that of an amplifier — crisply clear over a very flat range." He also noted that despite the short dial scale (14cm) "station readout is not impaired thanks to the signal and tuning meters which are in line with the scale."

Yamaha also took top honours in the FM tuner category. All but one of the panel listed the CT-800 among their top three choices — and in several cases as first choice. Audio critic Toshio Oka said, "the tuning is absolutely free of backlash. The smoothness with which the dial pointer moves across the linear slide-rule scale is very nice for pinpoint tuning, while the superiority of the CT-800's tonal quality deserves to be announced in gilt letters."

Another Japanese hifi magazine "Stereo Sound" recently awarded its "Seal of Special Merit" to Yamaha for their NS-690 loudspeaker system and their CA-1000 integrated stereo amplifier. In class A mode, the amplifier distortion is down to 0.015pc.

Why we decided not to advertise S.A.E.

Every amplifier manufacturer and his agent claims all sorts of perfection for his amplifier so what good is one more claim? Even though the claims are true this time?

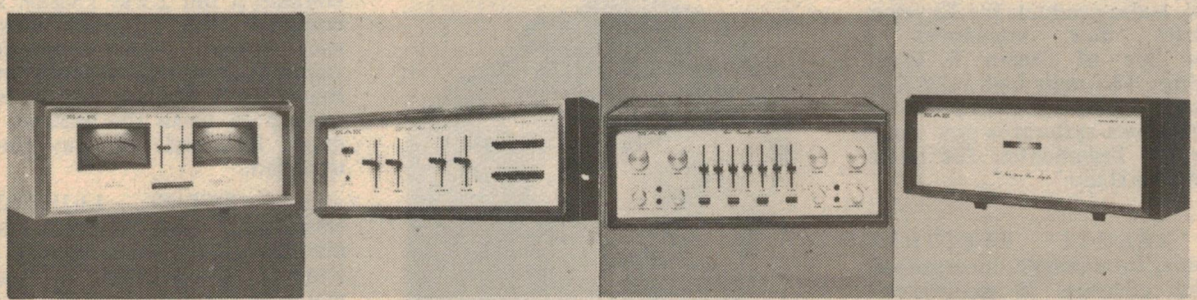
With all the exclusive break-throughs in circuitry, even the worst amplifiers must sound better than the real thing by now.

And we thought "S.A.E. never seem to advertise in the U.S.A., and yet they're accepted as America's best amplifiers and loudspeakers. All the pro's rave about them. So why should we advertise them? Anyway, with its performance, looks, price and warranty, S.A.E. gear should just walk off the dealers shelves.

Anyway our problem is not to sell S.A.E., but to get it. Our next two shipments are just about sold out, so what's the point in advertising? It'll only make the supply position worse."

That's why we decided not to advertise S.A.E.

Still, we ought to use the photos they sent us.



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S.A.: Sound Spectrum 33 Regents Arcade Adelaide, 5000.

A.C.T.: Duratone Hi-Fi Cnr. Botany St & Altree Court, Phillip, 2606.

QLD.: Brisbane Agencies, 72 Wickham St., Fortitude Valley 4006.

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TEL-26 DYNAMIC $36.95

TEL-14/TWO-WAY
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TEL-29/LIGHTWEIGHT $19.95

TEL-111/ELECTRET $85.00

TEL-32Q/QUAD,
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There's a new name for Stereo & Quad Headphones:

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A leading designer and manufacturer of quality audio products for 40 years, Telephonics now introduces a complete line of Stereo & Quad Headphones. The same high reliability required for airline entertainment and communications systems is now made available by Telephonics, for home and professional use.

The TEL-111 ELECTRET Headphone, for example, incorporates the latest advances in electrostatic audio reproduction providing flat frequency response from 18 to 24,000 Hz, without the need for the conventional electrostatic power supply. And it reduces distortion to the vanishing point by using a stiff featherlight . diaphragm suspended between two permanently-charged plates. The result is the clean, crisp, Telephonics sound, unobtainable with any but the most expensive speaker systems.

The TEL-26 DYNAMIC Stereo Headphone reproduces sound so faithfully that once you hear it, you'll never be satisfied with anything less. It has a separate tone control and volume control on each earcup to permit precise volume, balance and tone adjustments. And Telephonics

mechanical 2-way speaker system gives you the 2-way sound without the cost.

For the breathtaking realism of quadraphonic sound, the TEL-32Q QUAD, 4-CHANNEL Headphone has two 2-way speaker systems (four speakers in each earcup) to let you discover sound you've never heard before. The Telephonics Balance Controller lets you sit in your favorite easy chair, far from your receiver or amplifier, and set the 4-channel balance exactly the way you want it.

The TEL-14 TWO-WAY Headphone contains a full 2-way speaker system, complete with crossover network in each earcup. Deep, smooth bass response from the woofers and the bright treble highlights of the tweeters overlap to make the presence of the music felt, just the way the artist intended.

The TEL-29 LIGHTWEIGHT Headphone, the "Weight Watcher" member of the family is easy on the budget. Constructed of air-light materials for hours of easy listening, the Lightweight never disturbs nor intrudes on the music, but is not completely isolating. A volume control on each earcup allows you to adjust volume and balance without returning to your amplifier.

If you want to hear Sound the way it was recorded, don't let an ordinary Headphone come between you and your music. Demand the exceptional. Ask for Telephonics.

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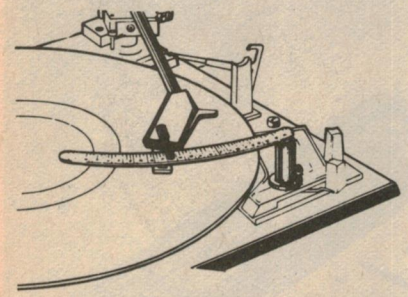
190 Willoughby Road, Crows Nest, 2065 N.S.W. Ph. 439-4201

BIB hifi accessories from Thorn Sales

If confirmation is needed of the booming public interest in high fidelity equipment, it is surely provided by the amount of hifi gadgetry currently on sale in department and specialist stores. Catering for this market, Thorn Sales are currently importing a wide range of "Bib" hifi accessories from the UK.



A freely illustrated brochure to hand from Thorn Sales lists over forty items, variously aimed at the users of disc, open reel tape, cartridge and cassette equipment.

For the disc user, the Bib range includes three different models of tracking type groove cleaners, for manual and automatic players, along with replacement items for same.

In addition, there are various cleaning cloths and gadgets, protective sleeves and grips, stylus balance, record leveller, filing aids, a cueing device and a couple of presentation record care kits.

Other gadgets, intended primarily for reel-to-reel tape users, include labels, splicing aids, and a head cleaning kit. For cartridge equipment, Bib offers a tape head cleaner, test tape and a cartridge carrying case.

Cassette enthusiasts are particularly well served. There's a head cleaning tape, a test tape, a cassette wallet and a case, and a variety of cassette care gadgets, available either in a presentation kit or separately. A "salvage" kit helps the user to open a welded cassette for repair, while another contains a tool and labels to transform a discarded pre-recorded cassette into a suitably labelled blank. If an enthusiast wants to edit and splice cassettes, the wherewithal is available to do it.

Sundry general purpose tools round out the very extensive Bib range.

Though relatively new on the Australian market, Bib products are now making their appearance in stores. Further information can be obtained, however, from Thorn Sales, 123 Bamfield Rd, West Heidelberg, Vic 3081.

SONY TC-755

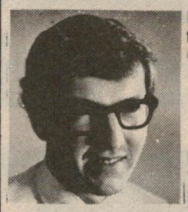
For those who need an order of performance better than normally available from a cassette style recorder, Sony have recently released in Australia their TC-755 open-reel recorder, as illustrated.

It is a 3-head, 3-motor machine, which will accept 27cm reels, and will operate at either of two speeds, 19 or 9.5cm / s.

Performance specifications are impressive, to say the least. At 19 cm / s the frequency response is 20-30,000Hz, or 20-20,000Hz plus and minus 3dB. Signal / noise ratio is 56dB, wow and flutter less than 0.05pc and distortion less than 1.2pc. It has ferrite heads and comprehensive access and control facilities.

Details from Sony Kemtron Pty Ltd, 469 Kent St, Sydney, 2000.

SOUND VIEWS



Recommended Enclosures for C12P and C12PX Hi-Fi

by Michael Barabasz "Loudspeaker Design Engineer".

Speaker enclosures have been a very controversial subject, generally due to lack of understanding of their effect upon the system performance. Here I will discuss two recommended enclosures of the vented type.

The loudspeaker performance is predictable when the enclosure details and the following three speaker parameters are known, i.e. (a) fundamental free air resonance (40 Hz), (b) the volume of air equivalent to the total speaker suspension stiffness (7.3 cu. ft.), (c) the total loudspeaker Q (= 0.45). The numerical values stated above are typical values for the C12P and C12PX HI-FI 12" models.

The best results are obtained with an optimum enclosure volume of 5.5 cu. ft. This is derived from the relationship that the volume equivalent to the loudspeaker compliance is 1.4 times the optimum enclosure volume. Suitable internal dimensions for such an enclosure are 23"W x 12½"D x 33"H. The enclosure should be constructed from at least ¾" thick material and adequately braced. In addition the enclosure should be tuned to loudspeaker resonance frequency. This is achieved with a rectangular duct 7" x 4" I.D. and having a depth of 3⅜". The position of the duct is not critical but a suitable position would be 2" away from the bottom wall. The theoretical response for such a system is 3dB down at 40Hz.

However, due to large physical size many of us would be prepared to accept some compromise in bass performance resulting from a small enclosure. People in this situation would be wise to consider a 2.5 cu. ft. vented enclosure having internal dimension of 17¾"W x 9⅞"D x 25"H manufactured from ¾" thick material. A 4" I.D. x 5" long vent would suitably tune this enclosure to loudspeaker resonance and the system response can be shown to be 3dB down at 56Hz and 10dB down at 40Hz. The bass reflex enclosure was chosen in preference to a sealed enclosure because it utilizes the output from the rear of the diaphragm and thus exhibits a higher bass efficiency. In addition operation at or near the enclosure resonance has the effect of damping diaphragm motion which in turn reduces distortion whilst acoustic output is maintained from the vent.

Measurements on this particular enclosure revealed that for the same output level the THD of the 2.5 cu. ft. vented system was lower than that produced with same speaker in a 2.5 sealed enclosure.

In the instance where the enclosure is to be fitted with a single wide range speaker the speaker should be mounted near the top of the enclosure. Where a C12P HI-FI is used as a bass driver in conjunction with tweeters, with or without midrange and associated crossover, then it is advantageous to mount the bass driver at the bottom of the enclosure and the tweeters to the top, with C6MR midrange in close proximity.

PLESSEY

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The Boulevard, Richmond, Victoria, 3121.
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AR62

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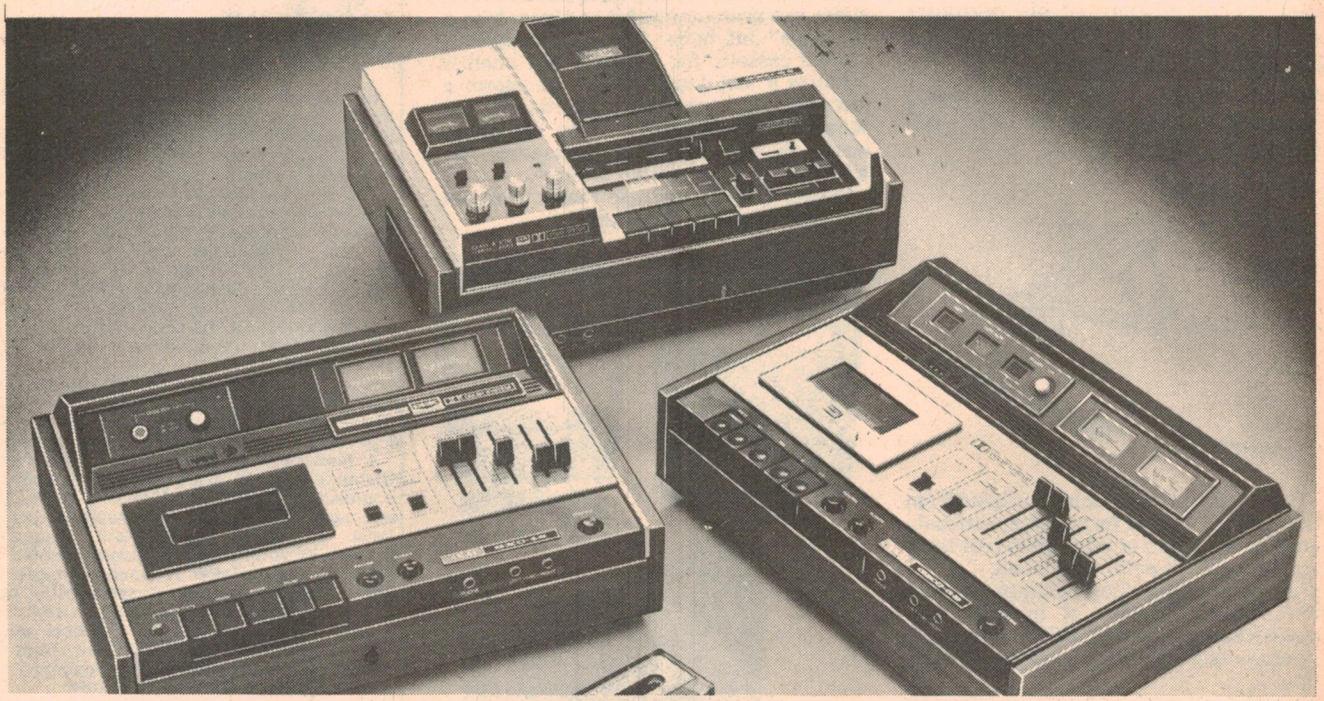

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The only stereo cassettes with built-in amplifiers that are available today are AKAI Stereo Cassette Recorders.
So that instead of buying a cassette deck, separate amplifier and two speakers, you now only need an AKAI Cassette Recorder and two speakers.
And when you remember that a respectable amplifier will cost at least $150, it's nice to know you can buy an amplifier already in a cassette recorder for what amounts to only $40 more than the equivalent model without one.
That's one big plus about AKAI Cassette Recorders.
But it is by no means the only one. For example: The AKAI GXC-65 Cassette Recorder (centre) has the GX-Head which doesn't allow dust to stick to it. Which means no more cleaning, and dust damage does not occur. Despite all this AKAI guarantee it for a lifetime!
The GX-Head is unique to AKAI. As also is the GXC-65's Invert-O-Matic automatic reversing system for continuous playback and uninterrupted recording.
The combination of GX-Head, AKAI's exclusive A.D.R. (Automatic Distortion Reduction) System, Dolby Noise Reduction System and a Special Tape Switch puts the GXC-65 in a class all by itself.

The GXC-46 (left) also boasts the lifetime guarantee GX-Head, the A.D.R. System, Dolby Noise Reduction and Special Tape Switch. As well as the epoch-making O.L.S. (Over Level Suppressor) circuit to reduce recording distortion.
Likewise the GXC-38 (right) is equipped with the GX-Head, Dolby Noise Reduction System, the O.L.S. circuit and Special Tape Selector Switch for CRO_2 (Chromium Dioxide) tape.
And as with the GXC-65 and 46, the GXC-38 has, of course, the AKAI 12 watt "total music power" amplifier.
Each cassette recorder is also available as a stereo cassette deck. In other words, without the built-in amplifier.
AKAI equipment (whether cassette recorders or decks, tape recorders or decks, amplifiers or speakers) all possess similar advanced technical breakthroughs and are all part of AKAI's world renowned expertise.
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Garrard release two new belt-drive record players

Although exhibited towards the end of last year, two new belt-drive Garrard record players have just recently become available on the Australian market. One of them, the Zero 100SB, has been developed from the highly successful Zero 100 and, as such, will be of prime interest to high fidelity enthusiasts.

by NEVILLE WILLIAMS

The other player, the 86SB, employs the same turntable drive mechanism but uses a conventional rather than an articulated arm — with, of course, a considerable saving in cost. The 86SB will be an obvious candidate for systems in which there is a greater emphasis on economy.

Release of the new Garrard players is particularly interesting in view of a discussion which the writer had, during 1972, with Mr Allan Say, chief design engineer of Garrard in England. Mr Say was in Australia, partly to promote the then relatively new Zero 100 player/changer.

In fact, the Zero 100 had been released in the United Kingdom in March 1971 but the demand was so high in the UK and the USA that it was not until well into the following year that the units saw the light of an Australian day.

The main point of interest about the Zero 100 was the articulated arm which changed the angle of the head assembly, relative to the arm, as it moved across the surface of the record. Details of the mechanism were given in our July 1971 issue. Included in the article was a curve which showed that a rigid arm will typically produce a tracking error varying from plus 1 degree at a 2-inch radius, to minus 1 degree at 3 inches, and to about plus 5 degrees at the outside of a 12-inch record. Only at two crossover points (radius equals 2.3 and 4.1 ins approx) is the tracking error zero.

Against this, the new Garrard cantilever arm, when properly set up, gave virtually perfect tracking across the whole surface.

In addition to the "zero error" feature, the arm design included a number of other refinements so that, even now, it still represents one of the most ambitious on the market. Cartridge tilt angle is variable, so that it can be set for either single play or stacked records. Anti-skating bias is provided by two disc magnets, which can be adjusted to provide just the right amount of "outwards" bias to offset the inwards pull of the groove and stylus. The counterweight is "decoupled" by a rubber bush to control arm resonance, and the playing weight can be adjusted accurately by a weight sliding against a scale calibrated to 3 grams.

In the discussion which Jim Rowe and I had with Allan Say, it was evident that the Zero 100 was very much his "baby", and the climax to many years of mass producing less ambitious record player/changers. He talked at considerable length about the parameters which governed the design of arms and cartridges. To a large degree, it seemed that the Zero 100 was his company's reply to the common assumption that a record changer must fall short of true high fidelity requirements, because of the work load on the mechanism, and the necessarily high playing weight.

Here, in fact, was a unit which could be set up either as an automatic player with rotating centre spindle, or as a regular changer. It had zero tracking error, other modern refinements and it could track, if need be, with a playing weight of less than 1 gram — about a half that required by the average high quality magnetic cartridge.

Acting as "devil's advocates", Jim Rowe and I questioned the provision for record change facilities. Would an enthusiast, who found it appropriate to use a high quality magnetic cartridge, be likely to stack his records in changer mode? If not, wouldn't the changer mechanism be something of a waste and a possible extra source of trouble?

Alan Say's retort was simply that the Zero 100 was designed to meet a range of needs. It could be used as a straight automatic player, with a high quality head, for prestige recordings. But it offered the changer facility for those who may need it, without the limitations of a less refined design. In fact, by changing the spindle and possibly the headshell, the same player could be used in two distinct roles in a family situation.

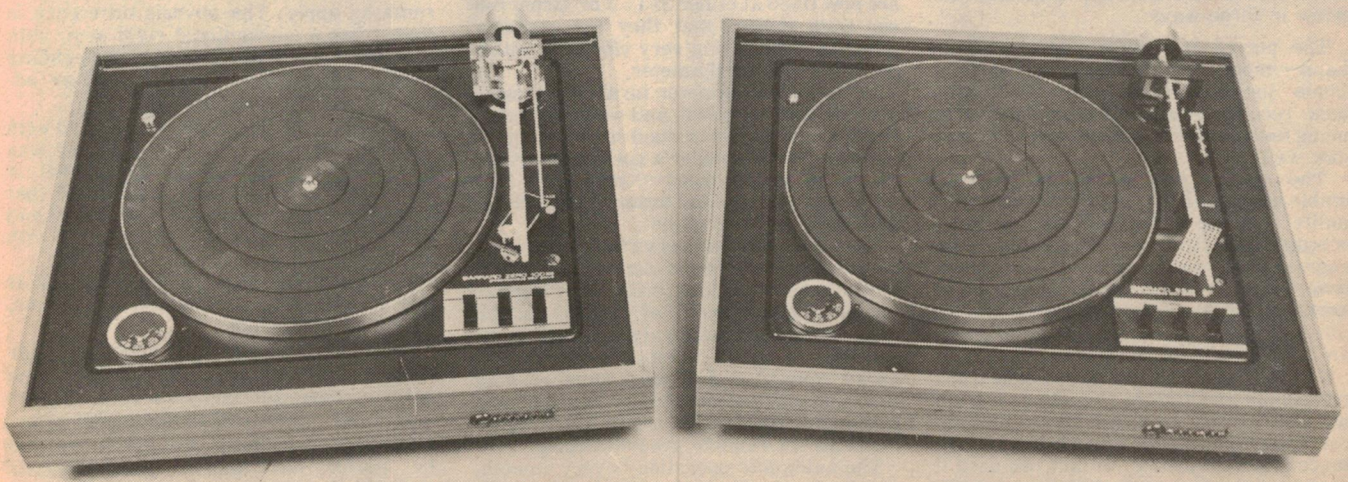
Allan Say pointed out that, in the USA, preference for record changers in the high quality market was much stronger than in the UK or Australia.

What about the zero tracking error? Did it offer a discernible improvement in sound over a conventional, high quality rigid arm?

Allan Say's reply was more cautious. If we were talking about gross distortion, the answer would have to be "no" because, if it were otherwise, other major and respected manufacturers would certainly have accepted the challenge of an articulated arm.

However, he had reason to believe that there were second-order benefits to be had

On the left is the new Garrard Zero 100SB automatic player. The 86SB on the right has the same drive mechanism but a rigid rather than an articulated arm.



GARRARD PLAYERS

from eliminating tracking error, including a reduction of more subtle distortion effects, improved balance between tracks and preservation of stereo phase relationships. Such effects could only be isolated by a carefully organised research program.

From there we turned to the drive motor. With so much attention to the arm and head mechanism, did it not seem odd that Garrard had retained a conventional idler wheel drive to the turntable? Why not belt drive, which surely must offer much more mechanical decoupling between the high speed drive elements and the turntable?

These questions had obviously been asked before and Allan Say was ready with a defence for the company's decision: Provided proper care is taken in the design, and quality control is maintained, rumble need not be a problem with an idler wheel system, he said.

It was, far and away, the most commonly used drive system and had been used in literally millions of players by his company alone. It was a system from which a high degree of reliability could be expected and this had to be a major consideration in the marketing of a new product line.

He went on to stress that belt drive was not the automatic panacea that it was sometimes thought to be. Belts could become misshapen and run unevenly, if great care was not taken with the material. Even then, they could flap along unsupported sections and introduce a speed modulation as a result.

Would his company be considering a belt-driven version later?

Maybe yes, maybe no. But first they had to produce enough of the existing model to meet world demand!

And, there, Allan Say had a point. Between March 1971, when it was released, and June 1972, production of the Zero 100 had reached the 100,000 mark and it was on its way to its second 100,000 while its designer was talking with us in Australia.

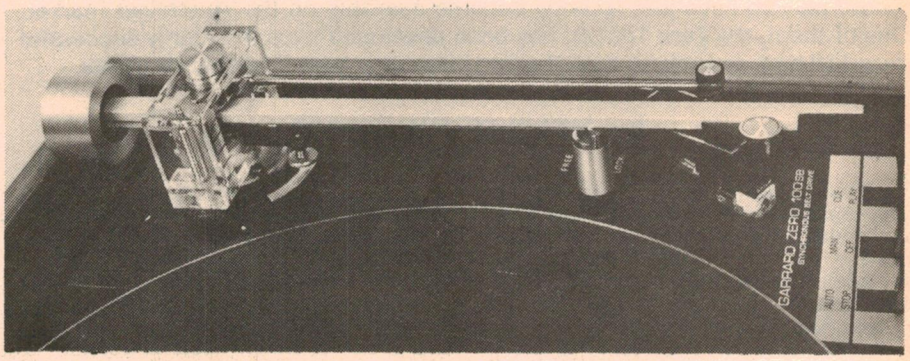
And, for a relatively expensive unit, those are not bad figures!

Our review of the Zero 100 was published in the April 1972 issue and was substantially favourable. Since then, the writer has been using the same player over fairly lengthy periods and is in a position to qualify the review in three ways:

1. The player has rarely been used in changer mode, because the writer is not a "chain" listener and has little inclination to stack records. The automatic play and cueing features are valuable, however, and work well.
2. The earlier comments about motor rumble were justified. Under ordinary high quality listening conditions, with average recordings, the rumble is sufficiently below program level not to present a problem. However, under provocative conditions of accentuated bass, or acoustic feedback, or with low level recordings, motor rumble can become evident to the critical ear.
3. We stated that the changer would track and trip the mechanism reliably at 1 gram and that 1½ grams would be an entirely practical playing weight. The figures do the player less than justice. In fact, we used it for most of the time with an Empire 1000ZE cartridge, with the tracking weight set at ¾-gram. Tracking and tripping was at all times completely reliable.

That the Zero 100 suits many users is evident from the continuing high sales. It will continue to be available in Australia as Garrard's top of the line record changer at a recommended retail price of $188.50. A suitable base and perspex cover is priced at $24.00. A magnetic cartridge can be supplied separately but it is assumed that, in many cases, purchasers will prefer to make their own arrangements.

In view of what has been said, it will be apparent that the new Zero 100SB unit is, in fact, the kind of unit that our discussion envisaged — one biased definitely towards the enthusiast market.



Close-up picture of the Zero 100SB articulated arm. The counter mechanism is built into the base moulding, closest to camera. Curiously, the first electric gramophone motor produced by Garrard and Company in 1928 was the model E, which used belt drive to the turntable.

The most important change, of course, is the substitution of belt drive and this provides the expected bonus: a reduction of rumble by more than 10dB. Actual measured figure from the randomly selected unit was: rumble less than —45dB, measured against 5 cm / sec at 1kHz (unweighted). Maker's specification is —63dB (DIN B)

The drive motor is a 4-pole synchronous type, fitted with a two-step pulley. A belt of synthetic rubber is used, which is shifted between the steps by a guide, forming part of the speed change and auto-play mechanism. Four positions are provided to accommodate 12, 10 and 7 in discs at 33-1 / 3rpm, and 7in at 45rpm.

Substitution of belt drive has meant sacrificing a feature of the original Zero 100, namely the vernier speed adjustment and the in-built illuminated strobe. The speeds are now fixed at either 33-1 / 3 or 45rpm but our tests showed that they are virtually "spot-on", indicating very close control on the drive spindle diameter.

An 11½-inch diameter turntable is used, die-cast and machined, and weighing 2.3kg. It carries a heavily ribbed mat to support the disc. Manufacturer's specifications for wow and flutter read "typically 0.12pc peak" and, in practical terms, it can only be described as "negligible".

The articulated arm is virtually the same as fitted to the original Zero 100, ensuring virtually zero tracking error. It is hard to escape a conviction that the articulated mechanism must add to arm stiffness but it certainly can't add much, because the unit tested tracked and tripped quite reliably with a playing weight of only ½-gram. Most cartridges themselves need much more than this for reliable groove tracing.

The automatic operation is very smooth, as also is the manual control. The cycle takes 11 seconds from initiation to play (with a 33rpm disc) and 5 seconds to switch off.

Initial setting up involves sliding a counterweight with compliant centre along the arm — still a rather fiddly operation! Once balance has been achieved, the actual playing weight can be set with the calibrated slider beneath the forward section of the arm. Bias torque can be set to suit the playing weight and the type of stylus.

The one criticism we had of the Zero 100SB is that, with a tall cartridge in the headshell (or tray), the arm is canted slightly upwards towards the disc. Functionally it is not important but an arm always looks better if its playing attitude is horizontal.

If the Zero 100SB has lost one feature, in the variable speed / strobe light system, it has gained another which will be of interest to the enthusiast. A resettable counter on the base operates each time the arm traverses the turntable and provides a good guide as to the number of playings with a particular stylus. The counter has a full scale indication of 1600 playings but it can be reset, or read in approximate hundreds of playings, providing a far better guide than the usual "guesstimation".

Recommended retail price of the Zero 100SB player is the same as that of the original Zero 100 player / changer: $188.50, plus $24.00 for base and cover if required. cartridge not included.

The drive mechanism of the less expensive 86SB player is virtually identical with that of the Zero 100SB and the same remarks apply. The obvious difference is that it has a conventional rigid arm, with resiliently mounted counter balance, sliding weight calibrated to 4 grams, and an adjustable torque compensator.

On test the 86SB performed very well with the one reservation that the lowering was not quite as smooth as the Zero 100SB. A spokesman for the distributors stated that this was not characteristic of the model and that its behaviour should be identical with the 100SB.

Recommended retail price of the 86SB is $129.00, plus $24.00 for the base and cover, cartridge not included.

Both players are guaranteed for one year from the date of purchase, the guarantee covering parts and labour. Service centres have been established in all capital cities.

The new Garrard players will be handled by major hifi dealers and stockists throughout Australia. If supply difficulties are encountered, inquiries may be directed to the distributors: Interson Pty Ltd, 64 Winbourne Rd, Brookvale, NSW 2100.

Sony presents a complete line of new mikes. From a tiny "tie-clip" model to a professional "paired" model for stereo pick-up, over fifteen different models are available to meet a wide variety of sound pick-up needs. Thanks to the successful utilisation of the electret principle which was pioneered by Sony, the professional "condenser" sound is now within the reach of amateur recording buffs. The crystal clear high tones and excellent transient response, so necessary for good music recording, are only attainable from condenser microphones. The absence of high peaks and deep valleys in the response of condenser microphones is also very desirable for P.A. (Public Address) use where elimination of acoustic feed-back and good articulation are essential. The moderately priced, maintenance-free dynamic microphones are especially suited for permanent or budget-priced installations.

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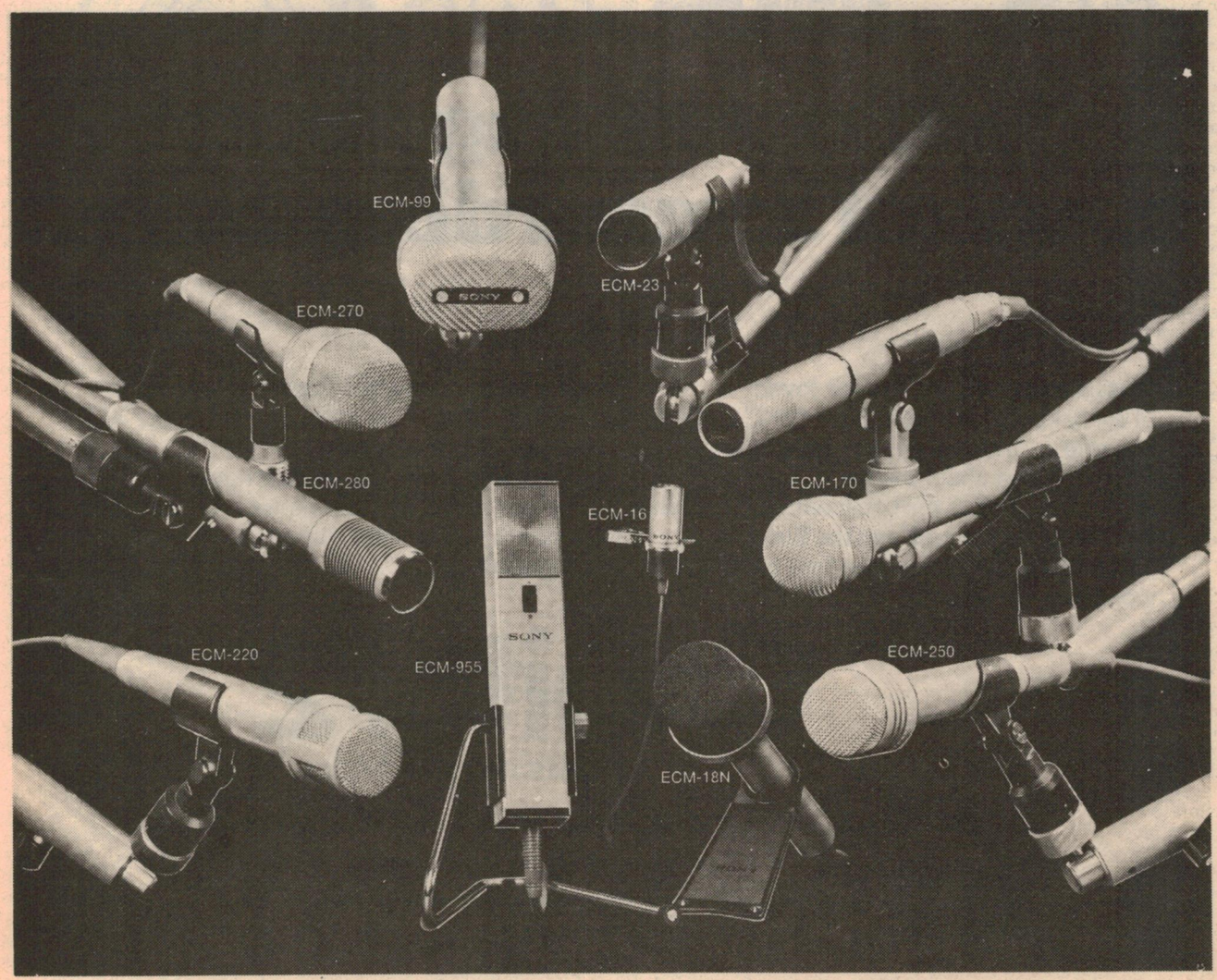
SPECIFICATIONS

	ECM-99	ECM-16	ECM-23	ECM-280	ECM-270	ECM-170	ECM-250	ECM-220	ECM-18N	ECM-95S
Directivity	Uni (one point stereo microphone)	Omni	Uni	Uni	Uni	Omni	Uni	Uni	Uni	Uni
Frequency Response	50-12, 000 Hz	50-13, 000 Hz	20-20, 000 Hz	30-18, 000 Hz	40-16, 000 Hz	20-16, 000 Hz	50-14, 000 Hz	50-12, 000 Hz	50-12, 000 Hz	70-10, 000 Hz
Output Impedance (100 Hz)	250 Ohms unbalanced	250 Ohms unbalanced	250 Ohms balanced	200 Ohms balanced	200 Ohms balanced	200 Ohms balanced	200 Ohms unbalanced	200/10K Ohms unbalanced	250 Ohms unbalanced	1,500 Ohms ±20%
Output level (OdB = 1 V/10μ bar)	—56.8 dB	—57.8 dB	—56.0 dB —64.0 dB (w/pad)	—56.0 dB	—57.0 dB	—56.0 dB	—57.0 dB	—58/—41 dB	—56.8 dB	—54 dB
Signal-to-noise ratio (1000 Hz 10μ bar)	Better than 60 dB	Better than 66 dB	Better than 66 dB	Better than 64 dB	Better than 66 dB	Better than 64 dB	Better than 66 dB	Better than 64 dB	Better than 60 dB	Better than 60 dB
Inherent noise	Less than 34 dB SPL	Less than 28 dB SPL	Less than 28 dB SPL	Less than 30 dB SPL	Less than 28 dB SPL	Less than 30 dB SPL	Less than 28 dB SPL	Less than 30 dB SPL	Less than 34 dB SPL	Less than 34 dB SPL
Wind noise	Less than 45 dB SPL	Less than 50 dB SPL	45 dB ±5 db SPL	Less than 50 dB SPL	Less than 50 dB SPL	Less than 40 db SPL	Less than 50 dB SPL	Less than 50 db SPL	Less than 35 dB SPL	48 dB ±5 dB SPL
Maximum sound pressure level	126 db SPL	126 dB SPL	130 db SPL	128 dB SPL	126 dB SPL	126 dB SPL	126 dB SPL	126 dB SPL	126 dB SPL	122 dB SPL
Dynamic range	92 dB	98 dB	102 dB	98 dB	98 dB	96 dB	98 dB	96 dB	92 dB	88 dB
Weight	285 g (10 oz)	31 g (1.09 oz)	190 g (6.7 oz)	145 g (5.1 oz)	125 g (4.4 oz)	160 g (5.6 oz)	145 g (5.1 oz)	275 g (9.6 oz)	180 g (6.3 oz)	140 g (4.9 oz)

Stand by to record - with Sony!

SK371



They're talking about Capitol 2 recording tape

Musicians, hi-fi experts, music lovers of every kind are talking about the Capitol 2 cassette — the world's best iron-oxide tape. They're raving about the frequency response, (20Hz-20,000 Kz); the backcoating that makes the cassette jamproof; and the Stakpak — probably because it just happens to be the world's ultimate in cassette storage.

(Stakpaks come with 2 Capitol 2 cassettes that snap together like a chest of drawers — each with its own label).
Try the world's best iron-oxide tape.
And next time you hear someone talking about Capitol 2 . . . you'll know it's not just idle gossip.

Capitol 2

Gets the good sounds right.

EMI International leaders in electronics, records and entertainment.

Some basic rules of microphone technique

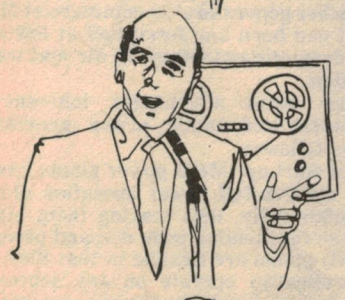
It's amazing how often a speaker, performer, or lecturer "loses" his audience simply because he doesn't take the time to master microphone technique. It is really just a matter of practice and common sense.

One of the most frequent errors occurs when a speaker turns away from the microphone and keeps on talking. His voice is lost — the microphone can't follow him. Face the microphone whenever you're talking . . . if you want to look around at various members of your audience, *make the microphone your pivot point,* and talk *across* the "face" of the microphone when looking to the left and right. On the other hand, you should turn away at times. A speaker who clears his throat or coughs directly into the microphone may rock an entire audience.

The sure sign of an amateur speaker is blowing into or rapping a microphone to see if it's operating. Yes, it indicates whether sound is coming through or not, but it doesn't give you any idea of the *volume* at which your voice will be reproduced. If you are the first speaker, test the sound system by talking. "One, two, three, four" is as good as anything else. (Of course, under most circumstances other speakers will precede you to the microphone. Listening carefully to them will give you a good idea as to the sound level of the public-address system. If the sound is low or too loud have one of your associates ask the sound man to adjust the volume to the proper level.)

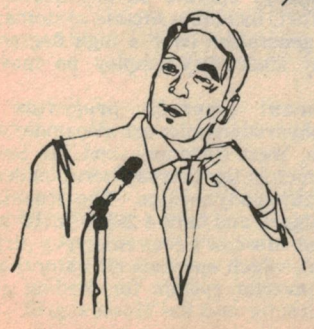
Don't fiddle with papers in front of the microphone, or handle the microphone itself in any way. Even very slight sounds may be amplified to an annoying extent. A loose-leaf notebook or 3x5 cards can eliminate this problem.

The speaker who gets up close and breathes into the microphone will blast his audience with hissing, sibilant (S-S-S-S-S or Sh-Sh-Sh-Sh-Sh) noises. Also he will produce a series of annoying breath sounds that go "pop-pop-pop" at every "B", "P", "D", "G", "T", "K" and other "hard" letters. (This problem can be solved by putting a windscreen on the Shure Unidyne microphone, or by using a Shure Unisphere ball-type pop and wind-proof microphone.) Also, standing too close to a unidirectional microphone can produce a "booming" sound. Proper microphone technique requires a speaker to stand *no less than 12 inches away, and speak over the top of the microphone or to one side of it* – not directly into it.



The day of the leather-lunged orator is over. Electronics has created an entire new method of public speaking. No longer is it considered good taste to shout at an audience throughout a speech. The relaxed, "fire-side chat" technique employed by skilled speakers is most suitable. You can warm up your audience immediately by speaking in a friendly, conversational tone. When the time comes to drive home a point, you may raise your voice — remembering to *back away from the microphone* when you do.

By all means, amateur speakers should practice their technique with a tape recorder before being turned loose on the public. Let them read their actual speech. When it's played back, they will hear the places in which they spoke too loudly or too softly or failed to remember they were using a microphone. A few sessions with the tape recorder will give almost any speaker a knowledge of good microphone technique.



DON'T "AH" and "UH" during pauses between words or sentences. DON'T USE REPETITIVE WORDS OR PHRASES. DON'T MAKE UNPLEASANT SOUNDS SUCH AS CLEARING THE THROAT, COUGHING, ETC. while facing the microphone. (If you must cough, turn away from the microphone.)

One very important suggestion: practice "talking" the address, *even if you intend to read it.* This "talking" effect can be achieved by listening intently to the sound of your voice coming back over the tape recorder and changing your voice technique when you re-record your address. Keep this cycle up until your "play-back" voice really sounds as if you're talking, not reading!

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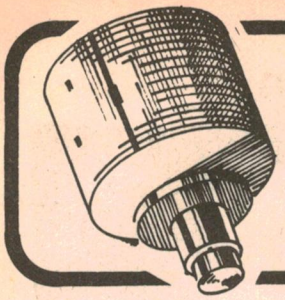


News Highlights

Ultra-sensitive solid state TV camera

The world's most sensitive solid state television camera — capable of taking pictures by the glow of a candle — has been developed by engineers at the General Electric Research and Development Center in Schenectady, NY.

Wallet-sized and weighing less than a pound, the new camera can be adapted for use with an ordinary television set to produce exceptionally crisp images even when light levels are extremely low.

The heart of GE's new camera is a charge-injection solid state imager — a quarter-inch-square metal-oxide-semiconductor chip. Covered with 10,000 pairs of miniature capacitors, the light-sensing chip performs the same job as the camera tube in conventional television cameras; ie it converts a visual image into an electronic video signal.

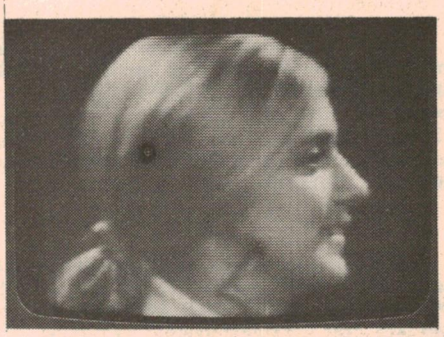
"Since this miniature camera can be fabricated with current solid state manufacturing techniques, it could potentially be manufactured for a fraction of the cost of a conventional television camera," Dr Arthur M. Bueche, GE Vice President for Research and Development, said today. "The compact, lightweight TV camera will be ideal for surveillance purposes on military bases and other high-security govenment installations, as well as in banks, museums, stores, and other businesses," the GE executive pointed out. "Another market may be the colour imaging systems in commercial colour TV cameras," he noted.

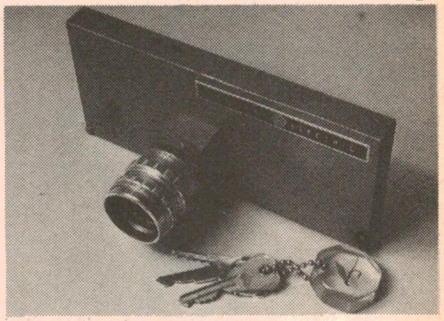
"The solid state TV camera may also have an eventual impact on the field of consumer electronics," Dr Bueche said. The device could be combined with a small video tape recorder and a home television set to produce "instant replay" home movies.

GE's new camera is smaller and has more than nine times the resolution of another developmental solid state television camera announced last year by the General Electric Research and Development Center. As in the previous camera, each pair of capacitors on the imager chip functions as an individual light-sensing device. As light strikes the chip, each capacitor pair collects a charge proportional to the light striking it.

To process the electrical charge into a television picture, each pair of capacitors is individually addressed by scanning circuits to release its charge, "injecting" it into the base of the chip. Electronic circuits process the charge to reproduce the image on a television screen. The imager can be scanned at speeds compatible with ordinary television sets.

The developers of the new camera, GE project engineers Gerald J. Michon and Hubert K. Burke, believe that the charge-injection principle offers several important advantages for their camera. Since no special structures are needed for transporting the signal charge, almost the entire chip can be made photosensitive, giving the GE TV camera by far the highest sensitivity yet achieved by a solid state imager.





"Another advantage is the chip's high tolerance to defects," the developers say. "If a pair of capacitors should fail, the result is only one minute dark spot on the screen. In other types of solid state imagers, the charge is passed from capacitor to capacitor for processing, and failure of a single element can mean darkening of an entire line in the picture.

"In addition, our imager produces the clearest and sharpest pictures known to date in a solid state television camera, and it maintains this high picture quality even under low light levels because we don't lose part of the signal in transferring it before processing," Burke and Michon point out. Under low light conditions, the scanning rate of the camera can be slowed for still greater sensitivity, as might be required in certain specialised situations.

Although the present GE camera lacks the resolution of commercial television cameras, future models are expected to approach and possibly equal commercial TV camera picture quality.

Renewed interest in MHD energy

The Avco Everett Research Laboratory Corporation, a pioneer in the field of magnetohydrodynamics (MHD), is preparing for a resurgence of activity in this field as the energy crisis worsens. Developed originally to simulate re-entry conditions for ballistic missiles, MHD generators could possibly be used to generate electricity from coal and other fuels more efficiently, and with less pollution, than present systems.

Basically, magnetohydrodynamics consists of passing a high temperature, highly ionised gas through a magnetic field and tapping off the electricity generated. The exhaust gases from the magnetic field "channel" still possess a large amount of residual energy which can be used to drive a more conventional turbine generator to produce additional electricity, or it can be used to pre-heat the gas fuel which has to be heated to some 3,000F to ionise. Additional ionisation is achieved by seeding the gas stream with cesium or potassium carbonate.

Avco researchers, and others, have been doing research and development on magnetohydrodynamics for the past 15 years, including design, fabrication and operation of experimnetal MHD generators. On the basis of this work, Avco claim that it is feasible to have a large coal-fuelled, commercial MHD generator in operation by the mid-1980's. In addition to having a conversion efficiency of 60pc (50pc higher than other generators), a commercial MHD plant can burn any fossil fuel at low cost with dramatic reductions in air and water pollution.

Other main advantages inherent in magnetohydrodynamic power generation are as follows:

- Fast start-up; MHD power plants can go from start to full power operation almost instantaneously, thus making them highly suitable for meeting peak demand periods;
- MHD plants are flexible in that they can (theoretically) operate on any source of heat or fuel, including atomic systems;
- MHD generators have a high degree of reliability since they employ no moving parts.

Significant research programs on magnetohydrodynamics are also under way in Japan, West Germany, and the Soviet Union which is the present world leader in magnetohydrodynamics. The Russians have designed and built a 25MW MHD pilot plant near Moscow's Sheremetyevo airpot. The plant, which operates off natural gas, has an inverter system for feeding electricity directly into the Moscow grid.

NASA plans new infrared telescope

NASA plans to build and install the world's largest infrared telescope on Mauna Kea, Hawaii, according to an announcement made recently by Dr. John E. Naugle, NASA Associate Administrator for Space Science.

Mauna Kea, the highest mountain in Hawaii and nearly 14,000ft above sea level, was chosen for the $US6 million facility after extensive surveys of several potential sites in Hawaii, Arizona, and Mexico's Baja California peninsula. The 3-metre (120-inch) telescope will be operated as a nationally available facility for NASA by the University of Hawaii, under the overall direction of Dr. William Brunk, NASA Chief of Planetary Astronomy in Washington, DC.

The facility will be used primarily to provide supporting and complementary data to NASA's planetary exploration programs. Infrared observations of the outer planets and their satellites can provide basic data on the temperatures and surface characteristics of these bodies. Such information is desired in early 1977, prior to the launch of the Mariner Jupiter / Saturn mission, to optimize planning for the encounters with Jupiter and Saturn. The facility will also provide the US with a national capability for ground-based observations of other astronomical objects in the middle and far infrared portion of the spectrum.

An infrared telescope, while similar in general appearance to a conventional optical telescope, is uniquely designed to eliminate the effect of undesired local infrared radiation, either from the sky or from the telescope itself. The construction of a large infrared telescope has been one of the top priority items listed by the National Academy of Sciences in a recent study, "Astronomy and Astrophysics for the 1970's." Completion of construction is planned for mid-1976, with the first observations in early 1977.

The modest efforts made in this field over the past few years have already paid scientific dividends, including a better understanding of the nature of the planets, interstellar dust, exploding galaxies and galactic nuclei.

AWA appoints new Chairman

Mr J. A. L. Hooke has been appointed Chairman of Directors and Chief Executive of Amalgamated Wireless (Australasia) Limited. He succeeds his father, Sir Lionel Hooke, who died recently.

Mr Hooke is a first class honours graduate of the University of Sydney in Science and Engineering. He was awarded the University medal.

On completion of his university studies, he spent some months on overseas investigations and then joined Amalgamated Wireless Valve Co. Pty Ltd. at Rydalmere where he was appointed Manager of the Semiconductor Division in 1960.

He was subsequently transferred to an executive position in Amalgamated Wireless (Australasia) Limited as Assistant to Deputy Manager. He was appointed Assistant General Manager in 1966, Deputy General Manager in 1968, Deputy Managing Director in 1970, and Managing Director in 1971.

Colour transmitter contract to AWA

Six colour television transmitters have been ordered by the Australian Post Office from Amalgamated Wireless (Australasia) Ltd for the Australian Broadcasting Commission. The transmitters, which will be used as three parallel pairs at sites in Sydney, Canberra and Hobart, will be installed this year and will be ready for the colour service when it begins in March, 1975.

Of the latest design, they are being manufactured at AWA's North Ryde works. They incorporate the Marconi RF drive unit which provides low-level intermediate frequency modulation and shaping of the vestigial sideband characteristics required for television.

In the past decade there has been a progressive improvement in performance stability. Modern transmitters can be left unattended for two-month periods allowing the staff to concentrate on programme requirements in the studio. In addition, modern transmitters settle down much more quickly after switch-on than earlier models, normally reaching guaranteed performance in five minutes and levelling off within 30 minutes. This greatly reduces "waiting time" and means that the standby transmitter can be left completely unpowered.

Above, one of the colour transmitters undergoing tests at AWA's North Ryde works.

Computer reconstructs accidents

A new system in which a computer "investigates" and reconstructs highway accidents has been developed by the Calspan Corporation, Buffalo, New York. Accidents are reconstructed, by the computer, from information supplied by a mini-computer at the scene of the accident.

Calspan designed, built and successfully tested prototype units of the new system during the past two years under a $US200,000 contract from the National Highway Traffic Safety Administration (NHTSA), US Department of Transportation. A further $150,000 contract has been awarded to Calspan by the NHTSA to enable further refinements to be carried out on the system.

Raymond R. McHenry, assistant head of Calspan's Transportation Safety Department, said that the mini-computer automatically processes accident information at the scene. This information is then transmitted (by radio) in computer language to the large base computer which attempts to reconstruct the accident.

The data material used by the main computer for accident reconstruction includes a description of the vehicles, the type of accident, length and direction of skid marks, and damage to cars and obstacles, as well as data on debris, terrain, information provided by drivers and witnesses, and other relevant factors.

The computer is programmed to rank the importance and reliability of various items of evidence, and informs the accident investigator in the field when it has sufficient information to reconstruct the traffic mishap. The end result is a statement, by the computer, on the contributing factors and principal causes of the accident. If desired, the computer can also be programmed to indicate possible traffic law infractions.

At any time during the investigation, the mini-computer in the field van can provide, at the push of a button, an instant "sketch" of the reconstructed accident up to that point.

"We view this system as a major advance in the reconstruction of automobile accidents," Mr McHenry said. The computerised accident information, he explained, could also be used for the following purposes:

- Evaluation of the safety aspects of various makes of cars, and of the merits of existing protective systems for motorists;
- More precise determination of accident and injury causes. In particular, the role of the driver, the car, and the highway in a given accident could be determined.

Although the Calspan system for mathematically reconstructing highway accidents is highly sophisticated, the system has been electronically automated to the extent that it can be operated by police after only a limited amount of training.

— George E. Toles.

NEWS HIGHLIGHTS

Electronic mechanic for forklift trucks

According to the Industrial Truck Division of Allis-Chalmers Corporation, Matteson, Illinois, electric forklift trucks have many advantages when compared to conventional engine powered vehicles. These advantages include: lower costs, no pollution, and less noise.

Electric vehicles do, however, have their problems since they are controlled by fairly complicated methods. Maintenance equipment for these vehicles usually requires specially trained maintenance personnel.

Allis-Chalmers recently took the lid off a space age type of electronic control in which the various circuit modules that carry instructions to the working components (eg, drive motors, hydraulic pumps and brakes) are of the "plug-in" type. A device called an analyser is used to check the condition of these circuit modules. The analyser is a "go", "no-go" type involving pushbuttons which trigger responses that can be seen instantly on the indicator dial. By using the analyser and a simple instruction guide, even an unskilled person can locate the source of a fault.

The analyser is capable of testing battery voltage, and will detect faulty connections, electrical short circuits. the current level,

and the voltage level. In addition, the device can be used to test the various circuit modules. A complete test procedure takes about 10 minutes. Should a fault be located in one of the circuit modules, it is simply a matter of slipping the module out and replacing it with a new one.

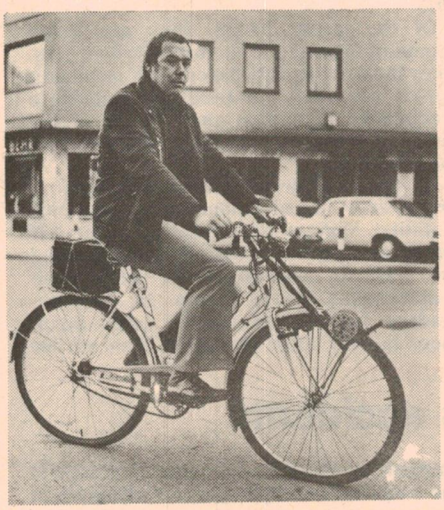
— George E. Toles.

Electric bicycle beats driving ban

A German racing driver / car accessory shop owner, Joachim Egenolf, 32, of Munich, has come up with an ingenious electric bicycle to beat the petrol shortage and the Sunday driving ban.

First, Mr Egenolf took the electric motor out of his lawnmower and mounted it over the front wheel of his bicycle, together with a small shaft that presses onto the tyre of the wheel. He then simply took the 12V battery out of his Volkswagen and placed it on the rear carrier of his bike, securing it with strong elastic bands — and connected the motor to the battery. The result — a simple battery powered bicycle capable of being operated either exclusively by battery or pedal assisted.

Mr Egenolf's invention is capable of speeds of up to 27½km / hour (approximately 19mph) and, if one uses nothing else but the battery, it will operate for a period of about one hour.



STC to supply microwave equipment to SEAQ

The Southern Electric Authority of Queensland (SEAQ) has contracted with Standard Telephones and Cables Pty Ltd to supply 1.5GHz microwave radio relay equipment to link South Pine Substation (Brisbane) with the new Gladstone Power Station and intermediate substations. The new microwave link will span a distance of 270 miles.

The 60-channel system will carry voice communications between the Authority's operating personnel, data system conditions (such as voltages, power demand, and the positions of circuit breakers in switchyards), and signals for the remote control of major transmission feeders. Other signals will automatically activate protective devices to prevent damage to costly equipment should a fault develop in the transmission line or generation plant.

In addition to the microwave system, STC was also awarded the contract for mobile radio and base station equipment, which will be used in conjunction with the radio links. A total of six VHF base stations will be supplied. These will be located at the main terminal points, South Pine and Gladstone, and at Donovan's Nob, Ghrooman Bille, Gin Gin and Miriam Vale along the transmisssion line route.

Improved communications for off-shore gas rigs

A £5 million project to provide reliable high-quality communications for gas and oil production platforms operating in the North Sea was recently announced by Mr Edward Fennessy, managing director of Britain's Post Office Telecommunications. Heart of the new communication system will be two new radio stations, each costing £500,000.

Scheduled to begin service in approximately 12 months time, the new stations will be equipped with 40ft dish aerials, and will provide communications for production platforms working oil and gas fields more than 200 miles from shore. It is planned to site the two new stations at Scousburgh in the Shetlands and Mormond Hill, some 30 miles north of Aberdeen. These two locations have been chosen so as to ensure the greatest possible area of coverage of the North Sea.

Because many of the gas and oil fields are well out of sight of land, the British Post Office is to use a communication technique it has never before used.

This is known as trans-horizon radio (tropospheric scatter) whereby powerful microwave-radio signals are beamed into the troposphere to become "scattered" by atmospheric turbulence, so that a very small but still usable signal reaches the receiving aerials.

The two new radio stations will provide direct communications to "master" production platforms which, in turn, will relay signals to other production platforms in their area by ordinary line-of-sight microwave techniques, using much smaller dish aerials. The Total Group, consisting of Total Oil Marine Ltd, Elf-ARAP, and Aquitaine, will provide the first two "master" platforms in the system. These will be the gas production platform now under construction for the Frigg gasfield 120 miles east of the Shetlands, and the manifold platform about 110 miles east of the northern tip of the Scottish mainland.

Acoustic method detects brain tumors

Research is currently under way at the Institute of Sound and Vibration Research, University of Southampton, England, into the possibility of using acoustic methods to detect brain tumours or the onset of multiple arterio-sclerosis. It is claimed that the new technique is capable of detecting the development of these two conditions earlier than X-rays, enabling surgeons to take the appropriate action with far less risk to the patient's life.

The new method uses a technique whereby responses to sound in the brain are recorded as electrical signals. The patient lies on a bed in a soundproof room, and his hearing system is fed with sharp clicks at a rate of 10 per second. Signals from the brain, in response to the clicks, are picked up by electrodes placed on the patient's head, and the resulting waveforms are analysed by a digital computer. The presence of a tumor, or lesion, affects the signals in a characteristic manner, and its position can be pinpointed.

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PRACTICAL PROJECT COMPETITION

To mark the release of its new 104-page catalogue, Kit-Sets Australia Pty Ltd are promoting this fascinating Practical Project Competition, open to all electronic hobbyists throughout Australia, New Zealand and adjacent countries. There will be three magnificent prizes:

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SECOND: Complete build-it-yourself kit for the Playmaster 140 quadraphonic amplifier.

THIRD: Complete build-it-yourself kit for the Playmaster 136 2-channel amplifier.

As a further incentive, all designs submitted will be considered for publication in "Electronics Australia" and a publication fee will be paid upon use.

Kitsets Australia Pty Ltd are sponsoring the competition and will be providing the prizes. However, entries will be handled and judged only by the executive editorial staff of "Electronics Australia".

THE PROJECT COMPETITION

Its aim is to discover a variety of practical electronics projects which it will be possible to build for approximately $20 including tax, based on prices quoted in the new Kit-Sets Australia catalogue. The price calculation must include all those items which you would normally expect to buy from an electronics parts supplier. Components which may have been bought from a clearance source must be assessed at normal catalogue price unless you can convince the judges that other constructors will be able to purchase the same part for the same price for some months to come. The cost of small scraps of timber, glue, screws and minor hardware oddments, likely to be found in a hobbyist's workshop, need not be included.

Remember, we are looking for practical projects which must have been designed, built, tested and shown to perform in a satisfactory manner. The projects may relate to radio reception, television, audio, instrumentation — or any other kind of activity which is likely to appeal to an electronics enthusiast and is appropriate for publication in an electronics magazine. It is accepted that most submissions will incorporate ideas drawn from other people and sources but they MUST contain a significant element of original planning. They MUST NOT duplicate a commercial product or a published design.

Projects which might cost more than the $20 limit will be considered by the judges but they will be at a disadvantage in the final judging. In practice, this will mean that large and expensive projects are unlikely to qualify for a prize.

CONDITIONS:

- Readers may submit as many entries as they wish but each entry must be submitted as a separate item, in its own envelope and complete with circuit, text, diagrams, board pattern, photos, etc, list of parts and prices, and declaration.
- Electronics Australia will take all reasonable care with entries but will accept no responsibility if they are mislaid.
- Projects should conform to normal requirements in regard to the law, safety requirements and community responsibility.
- Electronics Australia shall have exclusive publication rights to any design and information, which is the subject of an entry, for a period of 12 months from the closing date of the competition.
- All articles published will be paid for at ruling E.A. space rates. Copyright of the article in the form published will then be vested in Electronics Australia.
- Entries selected for publication will be reprinted in good faith, and credited to the Author. Electronics Australia cannot accept responsibility for statements or claims made or implied in the entry.
- Members of the staff of Kit-Sets Australia Pty Ltd and Electronics Australia are not eligible to enter the competition.
- The decision of the judges shall be final and no correspondence will be entered into.

TO ENTER THE COMPETITION:

You must submit a description of your project in a form suitable for judging and for possible publication in "Electronics Australia". Sufficient detail must be included to permit other readers to duplicate your prototype. In broad terms the judges will require:

A CIRCUIT DIAGRAM: Freehand will do, but lay it out in the general style of Electronics Australia circuits, so that the E.A. draftsman will be able to copy it with a minimum of effort. Include all component values and double-check for accuracy. You will lose points if the judges have to query apparent omissions and errors.

WRITTEN DESCRIPTION: Describe your project in terms broadly similar to those adopted for Electronics Australia constructional articles. You will need to explain what the project is supposed to do and how the design meets the requirement; how it works, points to watch in the assembly, testing and adjustment if required, and how it is used in practice. Write neatly or, better still, have your manuscript typed, double spaced. E.A. sub-editors will add the necessary "polish" before publication but do your best, because a carefully worded submission will gain more points than one which is skimped and careless.

PHYSICAL LAYOUT: To make it possible for others to duplicate your design, it may be necessary to include a sketch plan of the layout showing major dimensions and the position of major components. If you can enclose one or more photographs of the project, this could be an advantage.

SIGNED DECLARATION: Each entry must be accompanied by a signed statement that the project has been designed, built, tested and shown to perform as per the circuit, description and layout information; furthermore, that it does not, in the knowledge of the competitor, duplicate any commercial product or previously published design. It should be noted that, before awarding prizes, the judges may require that the relevant projects be authenticated by whatever means they can arrange.

REMEMBER TO ENCLOSE: Circuit, descriptive text, layout diagram and/or photographs, cost estimate, declaration.

CLOSING DATE:

Entries must be postmarked not later than Monday, September 2, or delivered to our office by the same day.

ADDRESS YOUR ENTRY:

"Project Competition",
Electronics Australia,
P.O. Box 163,
BEACONSFIELD, NSW 2014.

Australia's radio pioneers — 1

For Australia, the invention of radio was to mark the end to an era of isolation from Britain and the rest of the world. Its introduction into Australia is due mainly to the dedicated efforts of Australia's radio pioneers, for in other quarters it was hampered by slow government thinking, and by company rivalry. This article, the first of a four part series, describes radio pioneering activities in Australia up to World War I.

by PHILIP GEEVES*

It is generally agreed that Australia's earliest wireless experiments took place in the physics laboratory of the University of Sydney during 1888, when Professor Richard Threlfall repeated and demonstrated the work of Heinrich Hertz. Within the next decade, as news of Marconi's pioneering achievements filtered through to Australia, a few enthusiasts began their own experiments using basic apparatus, such as induction coils, spark gaps, Leyden jars and coherers. As might be expected, some of those eager experimenters were Post Office telegraphists, whose technical training equipped them to investigate the novelty of telegraphy without wires.

In Sydney, P. B. Walker, Engineer in Chief of Telegraphs, supervised experiments with a crude spark transmitter in 1899. The equipment was set up in the GPO . . . "at the extreme ends of the building two wires were fixed, one attached to the transmitting machinery and the other to the receiving apparatus. By touching the handle, the transmitter radiated, through space, electrical waves of very high pressure."

A Victorian telegraph official, H. W. Jenvey, became the leading wireless experimenter of Melbourne and inspired a number of other enthusiasts to emulate him. Walter Jenvey's leadership in the art was demonstrated during the Federation celebrations of 1901, when the Duke and Duchess of York visited Melbourne to open the first Commonwealth Parliament. Jenvey communicated successfully with one of the wireless-equipped escort cruisers and maintained contact over a distance of seventeen miles in Port Phillip. This pioneer's son, W. W. Jenvey, became Chief Engineer of OTC.

But not all our early experimenters were telegraph officers. At Henley Beach, Adelaide, in 1899, Professor Bragg's aerial was said to be "the first wireless pole erected in Australia." Sydney's most advanced experimenter was a legal luminary with a passion for science and degrees in both disciplines — Frank H. Leverrier, who began experimenting in 1900, designed and made all his own apparatus, some of which is now in the Museum of Applied Arts and Sciences, Sydney.

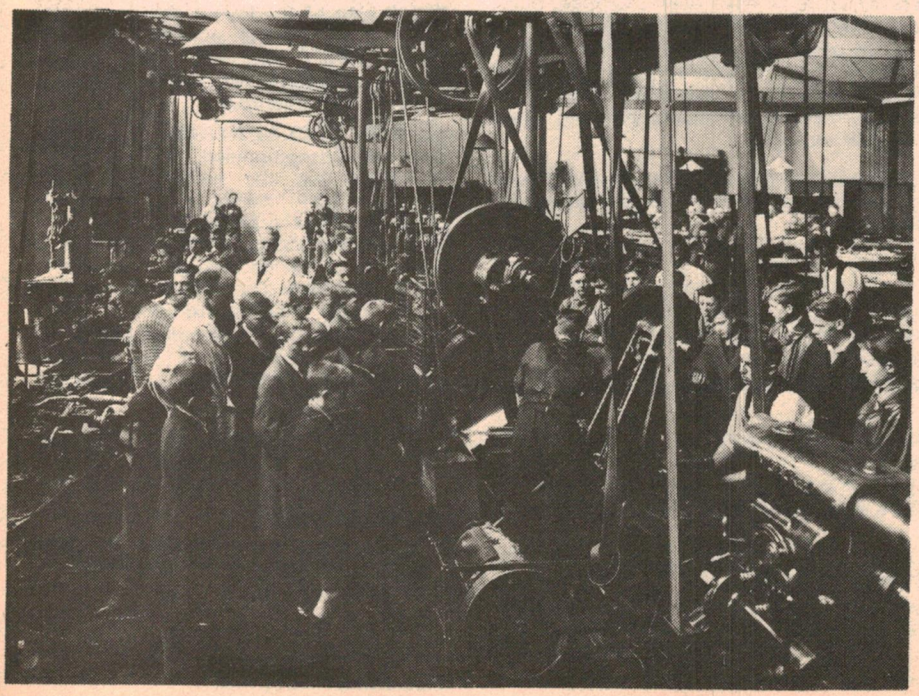
Leverrier's first detectors comprised oxydised steel points balanced on polished steel sheet. His unique knowledge of wireless and law gained him important briefs in patent litigation. Leverrier's son, also Frank, has held an amateur licence since 1924 and remains a staunch devotee of radio.

Viewed from Down Under, the success of Marconi's experiments in bridging progresively greater distances with the magic spark seemed to offer a method for linking remote settlements. When Australia's first Prime Minister, Edmund Barton, was asked about a wireless service between Tasmania and the mainland, he replied that the Marconi system had not been applied commercially to such long distances. Nevertheless, the Tasmanian Government continued to explore the possibility of wireless links with King Island and the mainland.

In October 1902 the Marconi Company submitted a proposal to the Commonwealth Government to connect Australia with New Zealand by wireless, but nothing came of the plan. The growing coolness of the British Post Office towards its imagined rival, the Marconi Company, was reflected in official Australian attitudes. Nor was the Government willing to adopt any other system, even though submissions were received from various international wireless firms, including Telefunken, Lodge-Muirhead, De Forest and Shoemaker. Australia's indecision was certainly not helped by the Admiralty recommending the adoption of Marconi's system, the same system which the British Post Office consistently opposed!

The Marconi Company was then in a period of vigorous expansion and during 1903 another effort was made to set up a Tasmanian service: for £5,000 the company offered to bridge Bass Strait with a wireless link guaranteed to handle the same volume of traffic as a submarine cable. Again the Government took no action. The time was fast approaching for Australia to announce an official wireless policy and the need became even more pressing in 1904, when

* Fellow of the Royal Australian Historical Society.



The machine shop of AWA's original factory, Sydney.

the Commander of the Australian Naval Station urged the establishment of coastal wireless at strategic points around Australia's long shoreline.

When the British Government legislated to control wireless, the Commonwealth Parliament hastened to do the same. The Wireless Telegraphy Act of 1905 was the result. It gave the Postmaster-General the exclusive right to transmit and receive wireless messages in Australia, and between Australia and other countries or ships at sea, but it also provided for the PMG to grant wireless licences on prescribed terms. Harsh penalties were included for unauthorised use of wireless apparatus.

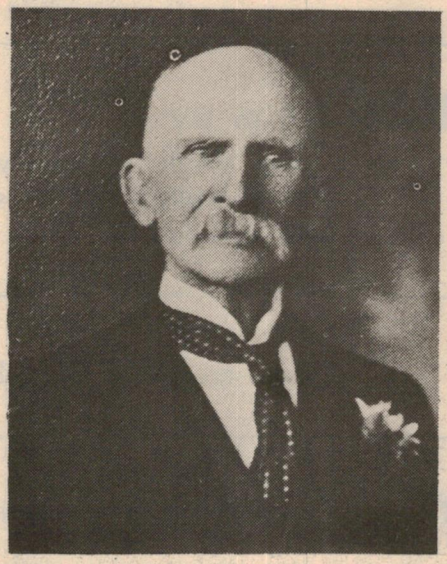
The Marconi Company was still hopeful that a practical demonstration might stir the Australian Government into adopting wireless so, following personal representations by one of its roving ambassadors, Captain L. E. Walker, the company erected spark stations at Queenscliff, Victoria, and Devonport, Tasmania. In the presence of many VIPs, messages were successfully exchanged between these stations over a distance of almost 200 miles on 12th July, 1906. The Government declined to purchase the stations, but it did agree to include in the Parliamentary estimates a sum of £10,000 earmarked for wireless telegraphy.

Although "wireless" remained a profound mystery to most people, each year brought new recruits to the tiny band of enthusiastic experimenters. In 1903, for example, Father Joseph Slattery, science master at St Stanislaus' College, Bathurst, acquired a set of Marconi apparatus and, after a series of familiarisation tests, succeeded in sending messages a distance of several miles — much to the delight of his pupils and the admiration of local citizens. Another early experimenter was Charles Percy Bartholomew of Mosman, Sydney, who built his own station in 1906. Bartholomew later became a director of AWA.

The prolonged inactivity and procrastination which characterised Australia's early flirtations with wireless ended after the important inter-Imperial Conference held in Melbourne, December 1909, at which the future provision of wireless communications in Australasia and the Pacific Islands was discussed. Australia undertook to build two land stations, one in Sydney and the other near Fremantle, to command the seaward approaches on either side of the continent.

Five tenders were received, the lowest figure of £4,150 per station coming from a syndicate of Sydney businessmen trading as Australasian Wireless Limited, a firm which had hurriedly acquired the regional rights to the Telefunken "singing spark" system. The equipment for these 25kW quenched spark stations was shipped from Germany and erected here under the supervision of Telefunken engineers. The modest tender submitted by Australasian Wireless Limited contrasted sharply with the price of £19,020 per station quoted by the Marconi Company, and was eloquent testimony that Australia had become the latest battleground in the incessant commercial "war" between the two principal wireless systems of the day.

The Sydney station was eventually sited at Pennant Hills, while its Western Australian counterpart was built at Applecross. These changes of location cost the Government an additional £4,000. The completion of both stations was plagued by vexatious delays, straining relations between Government and contractors. At the outset, the Pennant Hills station was designated POS (later VIS) and Applecross was originally POP (later VIP). The power for each station was supplied by 60HP Gardiner engines driving 500 cycle alternators.



At top, Guglielmo Marconi pictured with his experimental wireless apparatus. Above left is H. W. Jenvey, a leading pioneer wireless experimenter. Sir Ernest Fisk, the first technical manager of AWA, is pictured at above right.

1910 was a landmark year, producing a series of seemingly unconnected events which, as we now know, were to exercise a profound influence on the future development of Australian radio. Father Archibald Shaw, a former PMG telegraphist who had entered the Catholic priesthood, was granted an experimental licence for a station at Randwick, NSW; Australasian Wireless Ltd, successful tenderer for the first two coastal stations, opened experimental station AAA in Sydney which was destined to become Australia's first land station handling commercial traffic; George Augustine Taylor, a man of diverse interests and enthusiasms, formed the Wireless Institute of New South Wales, which had the distinction of being the first organised amateur wireless society in the British Empire and ultimately became a national organisation; Charles Dansie Maclurcan, later to emerge as the doyen of Australian experimenters, built his first telegraphy station on the roof of Sydney's Wentworth Hotel, which his family owned.

1910 was also the year that Ernest Thomas Fisk made his initial visit to Australia as Marconi operator aboard the "Otranto". Finding the rival Telefunken interests firmly entrenched, he returned here the following year as Marconi's resident engineer and for the next three decades remained the dominant figure in Australia's burgeoning electronics industry.

Perceptive observers noticed clouds on the wireless horizon. In England the Marconi Company had resorted to law to protect its patents and obtained an important judgment against the British Radio Telegraph and Telephone Company. Australia's two Government stations were Telefunken installations and despite spirited assertions that the German system

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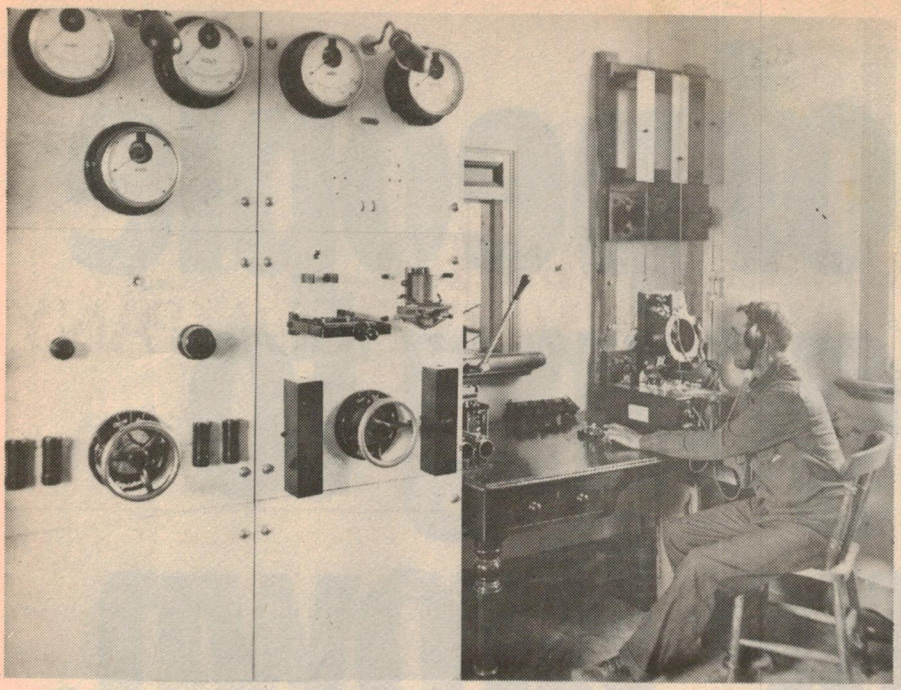

Above, an operator tunes the Telefunken receiver at Pennant Hills, Sydney, 1912. Below is the high tension room at Pennant Hills showing the original Telefunken equipment.

did not infringe Marconi's patents, it seemed that the Commonwealth might soon be engaged in litigation.

Politicians found themselves increasingly baffled by technicalities. When Marconi marine operators, in furtherance of the wireless "war" against Germany, refused to handle traffic from Telefunken-equipped ships, politicians assumed that the two systems were incompatible. After Labor Prime Minister Andrew Fisher took office in 1910, he decided to appoint a "wireless expert" to the Postmaster-General's Department.

The man selected for this key role was John Graeme Balsillie, a young Australian who had won recognition for his technical contributions to wireless and had installed stations in Russia, China, and elsewhere. Indeed, the main criticism of Balsillie's appointment was his previous association with the firm which had been found guilty of infringing Marconi's famous "Four Sevens" — Patent No 7777. Balsillie arrived in Australia in September 1911 and promptly began sizing up the fragmented wireless scene in his native land.

During 1911, twenty-four year old Ernest Fisk commenced building up the Marconi Company's representation from a small office in Sydney. The sole business of the Australian branch was marine wireless so, after persuading a shipowner to fit Marconi equipment, Fisk would attend to the installation, hire a Post Office telegraphist with a thirst for travel and train the recruit in wireless procedures. Two of Fisk's 1911 associates, J. L. Mulholland and J. F. Wilson, still live among us.

It was in 1911 that an experimental licence was issued to a Sydney schoolboy, Raymond Cottam Allsop, who had absorbed his knowledge from a kindly neighbour in Randwick, "the wireless missionary," Father Shaw. After war service as a marine operator, Allsop came to prominence during the 1920s and remained an honoured figure in Australian electronics until his death in 1972.

Predictably, Balsillie's appointment as the Federal "wireless expert" was viewed with apprehension by the big international firms. Their concern turned to alarm when it became known that, apart from the Telefunken stations at Pennant Hills and Applecross, all future coastal stations would use Balsillie's own circuitry and, moreover, their equipment would be supplied by Father Shaw's Randwick workshop. This bombshell touched off a spate of writs for patent infringement, far too complex to relate here.

The situation was resolved amicably in 1912, when the contestants agreed to form a new company to represent the interests of both Marconi and Telefunken throughout Australasia. The merger company, Amalgamated Wireless (Australasia) Ltd, was inaugurated in Sydney in July 1913 with Fisk as technical manager. Staffed by seasoned wireless men and with access to the patents of the world's leading systems, the firm had a formidable reservoir of technical expertise.

The formation of the company was indeed timely. The heroic role played by wireless

(Continued on page 90)

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Guided electromagnetic flight

The Magneplane: transport of the future?

Increasing demands on public transport throughout the world have forced the research and development pace on high speed surface transport systems embodying electromagnetic propulsion and guidance principles. In recent months, the development of such systems has been made all the more crucial by the world energy crisis, and significant programs are now under way in Europe, Japan, and the USA. Impressive results have been obtained from the Magneplane system, which is currently undergoing development at MIT.

Public transportation employing vehicles with wheels appears to be incapable of speeds much above those obtained by present day technologically advanced railways. Various alternatives to wheeled transportation are currently being investigated in such countries as Britain, the USA, Germany, Japan and Canada. Among the alternatives under consideration are air-cushioned transport, attractive magnetic levitation systems, and repulsive magnetic levitation systems.

Recent studies have made it increasingly clear that the future in high-speed ground transportation belongs to vehicles that "fly" about 30cm above metal guideways, being supported, guided and propelled by electromagnetic forces. Based on today's technology, speeds up to 500km / h are feasible. However, as technology advances, speeds far in excess of this figure will be realised.

One such proposal for an electromagnetically guided and propelled vehicle is currently undergoing research at the Francis Bitter National Magnet Laboratory of the Massachusetts Institute of Technology, in Cambridge, Massachusetts. Designated the "Magneplane" system, the research project is being conducted by a team led by Dr Henry Kolm and Professor Richard Thornton.

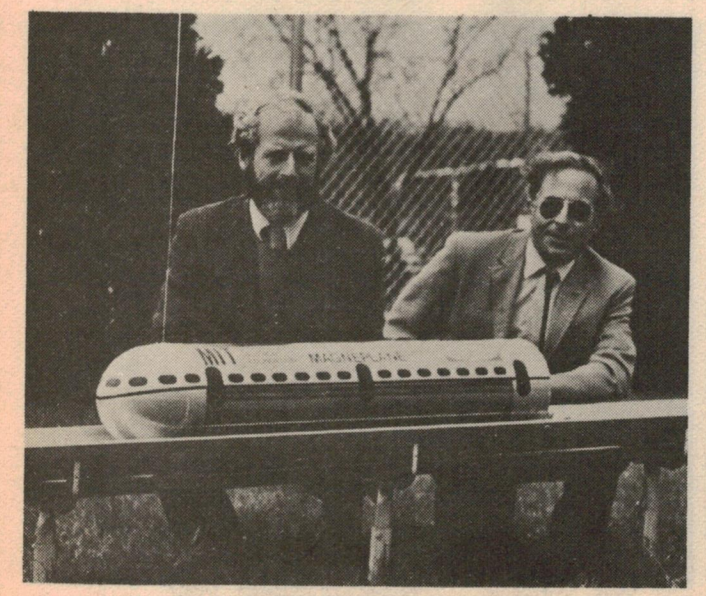
The basic principles of electromagnetic flight may be summarised as follows. A magnet moving along a conductive plate is repelled by the eddy currents its motion induces in the plate. This effect represents the electromagnetic analogue of aerodynamic flight, in that motion produces lift at the expense of drag. However, electromagnetic flight differs from aerodynamic flight in one essential respect: the lift force increases rapidly as the magnet approaches the conductive plate. This characteristic is utilised by the Magneplane to achieve guided flight, and in practice the Magneplane travels at an altitude of approximately 30cm above the guideway.

As is the case with an aircraft, and due to its altitude, the Magneplane is free to follow a smooth tragectory governed by its inertia, and is relatively unaffected by high frequency undulations in the guideway since these can be kept small with respect to the altitude. The vehicle is propelled by a linear synchronous motor.

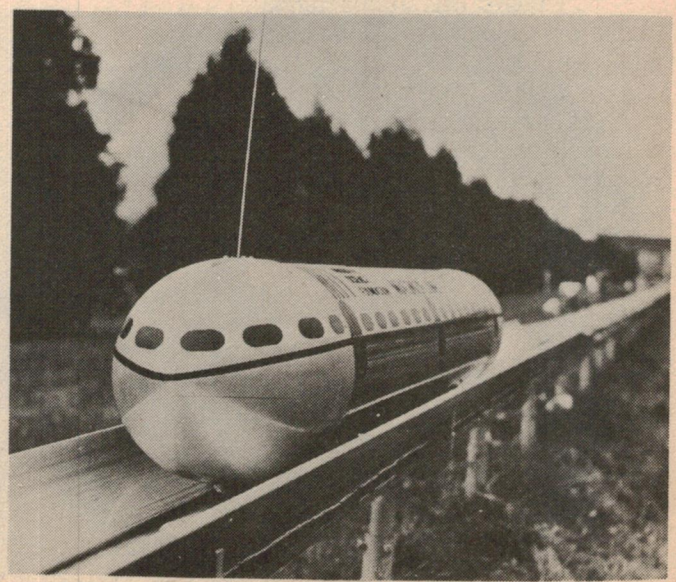
A fully operational 1 / 25th scale model of the Magneplane system has been constructed at the Wayland Laboratory of the Raytheon Company, a partner in the project. The model measures 20cm in diameter, and has a length of approximately 105cm. A full scale Magneplane will have a diameter of the order of 4 metres, a length of some 33 metres, and will seat from 100 to 150 persons.

The model shown in the photographs utilises the so called "rare earth magnets" or "samarium cobalt magnets." These are the most powerful permanent magnets known, and the magneplane model contains one of the largest collections of such magnets on earth, the only larger assembly being in the wheel motors of the lunar rover vehicle.

The scale model will accelerate to approximately 50km / h (30mph) on a 120 metre (approx 400ft) guideway. A more advanced model, employing a superconducting magnet, is expected to achieve a figure of 88km / h (55 mph).



The two leaders of the Magneplane project, Professor Richard Thornton (left) and Dr Henry H. Kolm.



A close-up view of the Magneplane in motion over the track. Propulsion is via a linear synchronous motor.

Kirlian photography: a puzzling phenomenon

Interpretation of the phenomena produced by Kirlian photography, or radiation field photography, is a current research project in both the Soviet Union and the United States. This article describes the theoretical aspects of Kirlian photography and discusses the results achieved thus far.

by THELMA MOSS and KENDALL JOHNSON

University College of Los Angeles, Center for the Health Sciences.

If one examines the Soviet literature concerning Kirlian photography, it soon becomes apparent that it is not yet known what phenomenon is being revealed by this photography. The four principal Russian investigators of the Kirlian method seem to be the inventors of the technique, Semyon and Valentina Kirlian, the Kazakh biologist, V. I. Inyushin, and the Moscow biophysicist, Victor Adamenko.

In their two basic articles, the Kirlians carefully describe their photography as a method for "the conversion of non-electrical properties of the object being photographed into electrical ones . . . with a direct transfer of charges from the object to the photographic plate." Inyushin has opted for the term "bioplasma body" as descriptive of the emanations and internal structure of the objects being photographed. Adamenko sees the photographs as demonstrating the "cold emission of electrons" which can furnish pertinent information about the nature of organic and inorganic materials.

Many American scientists have translated the phrase "cold emission of electrons" into the more familiar term "corona discharge"; and, as such, believe that this photography reveals nothing but a commonplace electrical phenomenon. This article discusses the results of our own experiments.

The apparatus, as used by us, is based on the principles described by the Kirlians, but uses a different schematic diagram and power source. It should be noted that in the work to be discussed, all results were obtained from only one type of apparatus. This apparatus has been standardised in terms of voltage, frequency, pulse frequency, wave form, and exposure time.

The standardised apparatus is an induction coil system powered from a 12 volt battery, and has an undamped harmonic frequency of approximately 1,500Hz and 3,000Hz. A pulse rate of 160Hz was employed. All photography was carried out in a dark room under constant temperature and humidity conditions. The maximum current was limited to less than 0.1 microamps.

The power source is situated outside the dark room and is connected by cables to the film holder, into which a 4in x 5in sheet of photographic film is inserted. A timing device is utilised so that, by pressing a switch, electrical current passes for exactly one second from the electrode into the object and onto the film. This procedure contrasts with the Kirlian technique in which the current is sent from the plate up into the object being photographed. This reversal of current flow may be responsible for a few of the results that we have obtained which seem to contradict those obtained by the Soviet scientists.

The object to be photographed is placed in direct contact with the emulsion on the film. Then, an electrical charge is sent through an electrode covered with a dielectric into the object being photographed. When working with human subjects, the subject simply holds the electrode in one hand.

By using this basic technique, more than 10,000 photographs have been produced in our laboratory over the past 10 months. Human finger pads, leaves, and metal objects have thus far been the principal subjects photographed. The results obtained from any one set of parameters have given such diverse results that a variety of controlled studies were devised to learn what was actually being photographed. This variation in results (under a constant set of physical parameters) particularly applied to photographs of the human finger pad, where results differed markedly from person to person, or in the same person over a period of time.

Fig 1 is a photograph of a five cent coin.

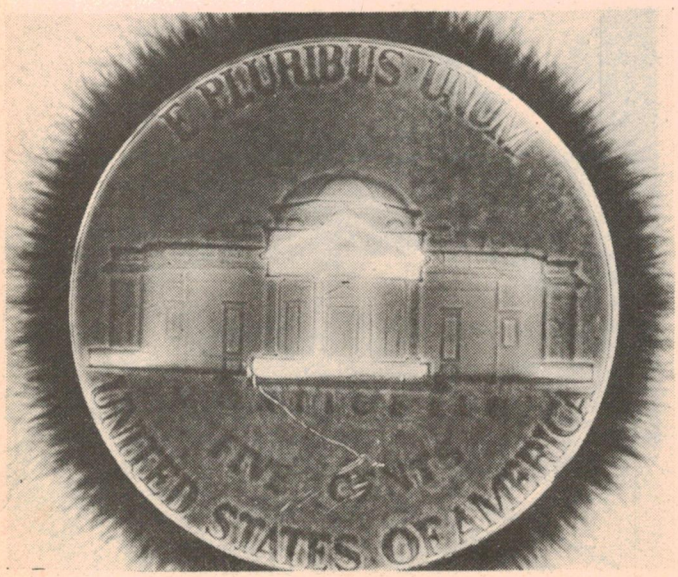


Fig 1: The surface details of this 5 cent coin have been reproduced with great clarity. Note the "corona discharge" emanating from the coin.

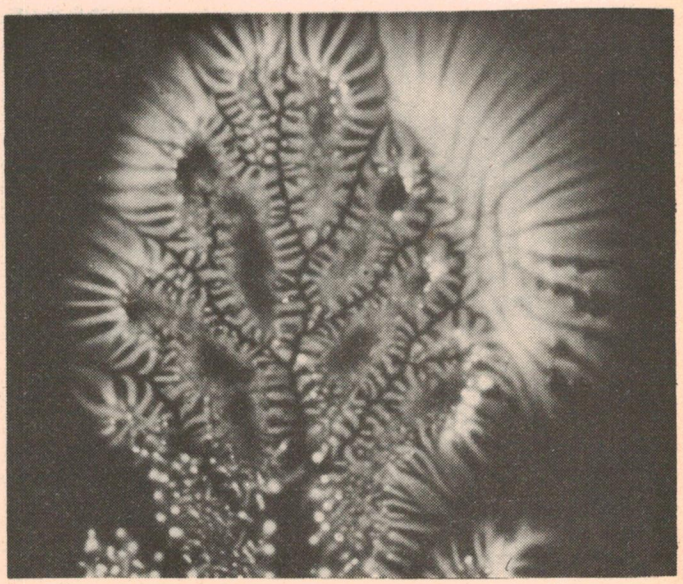


Fig 2: This photograph of a leaf clearly reveals the "corona discharge" beyond its borders. Note the internal structuring of "bubbles."

The surface details of the metal have been reproduced with great clarity. Beyond the rim of the coin is an emanation which has been described variously as "corona discharge," "bioplasma body," or "aura." Fig 2 is a picture of a leaf, again revealing the aura beyond its borders. But, instead of seeing the surface of the leaf as it appears to the eye (as with the coin), we find an internal structuring of "bubbles" which cannot be seen visually.

Subsequent tests have shown that the corona around coins and metals remains constant when all the parameters of photography are held constant, and is independent of such factors as, for example, the temperature of the coin. However, if the coin is photographed at a different frequency, or voltage, or pulse duration, or exposure time, we observe remarkable changes in the photographed coin. Similar dramatic changes have been observed with minerals, leaves, and finger pads when the electrical parameters of the photograph are varied.

Furthermore, it has been observed that the aura around a leaf will change in accordance with its physiological parameters. It was learned that the corona around the leaf, and its internal geometry, responded dramatically to physical stresses (eg, cold and mutilation) placed upon the leaf. Fig 3, for example, shows a fresh gazania leaf, whereas Fig 4 shows the same leaf after it had been gashed with a needle. The dark patch photographs as a vivid red blotch when colour photography is used.

A photograph of the right index finger pad of a human subject is shown in Fig 5. Again, the corona extends beyond the rim of the finger. The internal structure of the finger pad has been clearly revealed, showing both the fingerprints and some scar tissue. Fig 6 is a photograph taken of the same finger tip under the same photographic conditions, but on a different day. We see a totally different picture. Now there is no corona, nor are the fingerprints and scar tissue visible. Instead, we see a diffuse cloud-like manifestation extending for a distance greater than we have learned to expect of the aura. In colour, this cloud-like "blotch" characteristically photographs in vivid red, whereas the corona normally photographs in bright blue and white.

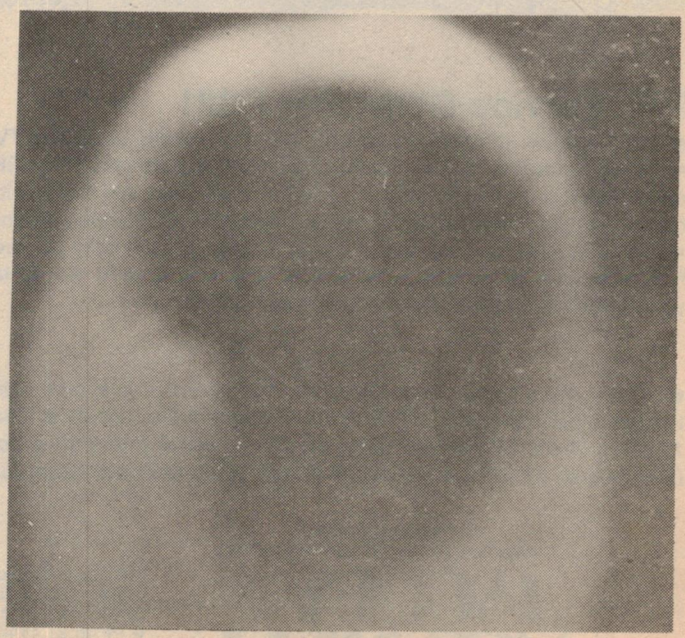
Fig 3 (above, left) is a photograph of a fresh gazania leaf. Fig 4 (above, right) shows the same leaf after it has been subjected to physiological stress.

During the course of our research, more than 500 persons have been photographed in our laboratory. An intensive examination of the photographs has revealed that each subject has a corona that displays a distinctly different pattern from the corona of other subjects. In fact, just as there are no two fingerprints alike, it appears that no two fingers have the same aura. Furthermore, after studying certain persons repeatedly over a period of months, it became clear that each subject's photographs can change dramatically from day to day.

For example, on certain days one subject shows a brilliant blue and white corona with clearly visible fingerprints. On another day, the same subject reveals a similar aura, but with no fingerprints visible. On still another day, there is only a red blotch and no aura. And occasionally, both the corona and the blotch appear simultaneously.

Very early in the work, then, it became clear that the emanations from human subjects change dramatically, and that these changes could perhaps be linked to physiological, psychological, or psychic conditions.

From time to time, different hypotheses were offered and then tested. Experiments were conducted to determine the effects of such parameters as changes in galvanic skin response, the state of vasodilation or vasoconstriction, sweat, and skin temperature. In all cases, there was no correlation between the photographs obtained and the parameter being evalued. It may therefore be stated, with a fair degree of certainty, that this photography does not portray known physiological parameters in



Figs 5 and 6: These two photographs of the right index finger pad of a human subject were taken under identical physical conditions.

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● Signal for standard colour test pattern ● Signals for red, green and blue raster ● Four-colour vector test signal ● Phase angle test signal for PAL decoder, using screen as indicator ● Electronic circle ● Grey scale, chessboard pattern, with 8 steps from white to black ● Three convergence pattern signals ● Positive or negative audio signal ● Modulated at 5.5 MHz or unmodulated ● Dimensions: 300 x 112.5 x 227 mm ● Weight: 4.3 kg.

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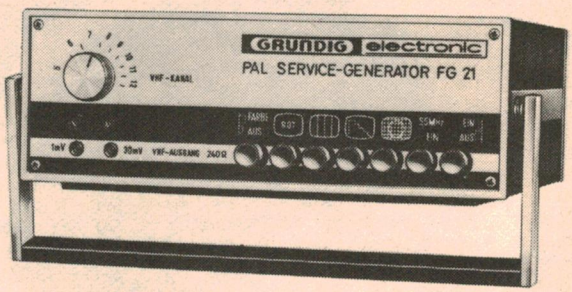

● Four-colour vector test signal ● PAL phase angle test signal – decoder alignment employing screen display ● Convergence pattern signal with electronic circle ● Grey scale ● Red raster ● 5.5 MHz sound carrier ● Test Patterns: grid raster, 12 horiz. lines; 16 vertical lines; electronic circle faded-in; 4 colour bars, corresponding to the colour difference signals ● Dimensions: 220 x 80 x 165 mm ● Weight: 2 kg ● Accessories Supplied: 1 aerial cable 241; 1 protective cover for back of FG21.

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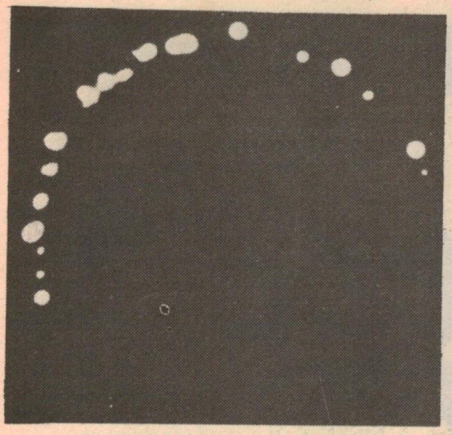
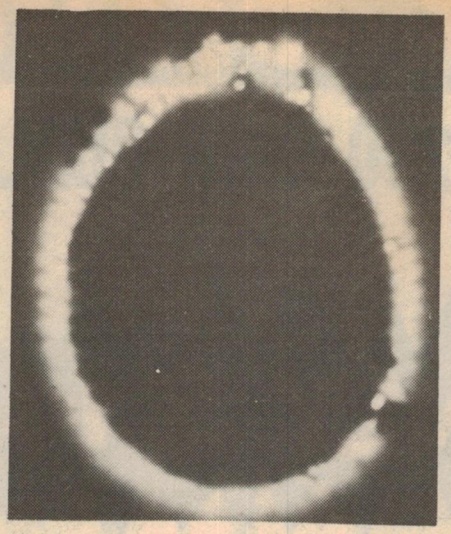
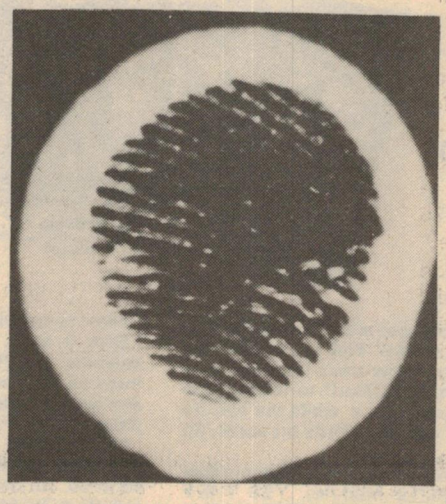




Figs G, H and I: These three photographs reveal the marked changes in a subject's corona due to varying degrees of alcohol intoxication.



human subjects.

It was then decided to examine psychological, rather than physiological states and, in particular, to examine different states of consciousness, such as those induced by drugs, hypnosis, and exercise.

Our pilot studies with drugs have included tranquillisers such as Valium, energisers (amphetamines), pain relievers, and alcohol. The effects of alcoholic intoxication is shown in Figs 7, 8, and 9. Fig 7 reveals a small sketchy corona that has come to be regarded as a sign of nervousness or anxiety. After one ounce of alcohol, the picture in Fig 8 was secured. After 17 ounces of alcohol the photograph shown in Fig 9 was taken. The three photographs clearly show a change in the subject's corona, which may be tentatively related back to his psychological condition.

Our principal drug study, which is still in progress, concerns marijuana intoxication (as part of a research project for the National Institute of Mental Health). Thus far, more than 65 subjects have been photographed in their normal, pre-drug state, and then photographed again under marijuana intoxication.

Considerable research time has been devoted to investigating the effects of hypnosis. Again, in general, we have found an increase in the width and brilliance of a subject's aura when he is placed under hypnosis. It would thus appear that states of relaxation induced by hypnosis and drugs produce, for the most part, a brilliant, wide corona, whereas in states of tension, or emotional excitement, we have come to expect a red blotch.

By far the most intriguing aspect of our work has dealt with the interactions between people. This phase of the research work began through an accidental discovery. A male subject was having a series of 6 photographs taken by a male photographer. After the third photograph had been taken, the photographer was called away on other business and his place was taken by a female photographer so that the last three photographs could be taken. The three pictures taken by the female differed dramatically from those taken by the male. As one might expect, the female elicited a much brighter and wider aura from the male subject.

After this accidental finding, several experiments were conducted in which all variables remained constant, except that the photographer was deliberately changed in the middle of the photographic process. It has been a consistent finding that there is a striking difference in the subject's corona when different photographers take the picture. Sex differences are important, but are not strictly necessary. Close friends seem to generate a brighter corona, when working together, than the corona produced by two strangers.

It is evident than many years of research lie ahead. Soviet investigators have already been able to study these phenomena with highly sophisticated equipment such as electron microscopes, motion picture techniques, and closed circuit TV. By comparison our equipment is primitive but, even so, it is clear that radiation field photography reveals a highly complex, perhaps still unknown phenomenon. If the phenomenon is, in fact, a corona discharge, it would seem that the changes which occur in the corona discharge under varying conditions make this commonplace phenomenon worthy of intensive study.

At this moment in time, it is impossible to draw any conclusions about this research except one. Whatever these pictures reveal — corona discharge or bioplasma — the changes which have been observed to occur in organic materials demonstrate that a most interesting, and as yet undeciphered, story is being told. And here lies the challenge.

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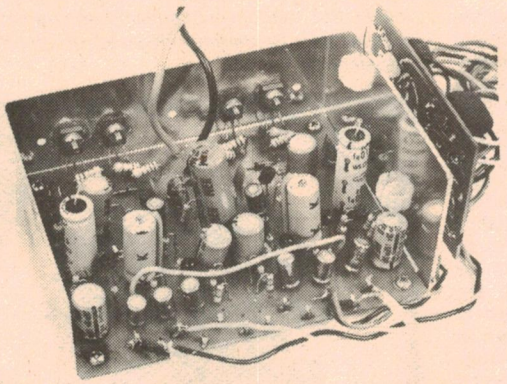

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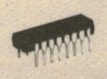

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OA91	.25	.20	.15
OA95	.25	.20	.15
OA200	.30	.25	.20
OA202	.30	.25	.20
IN4148 (IN914A)	.15	.13	.10

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OC 45	.42
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OC 72	.42
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EM401 / IN4002 100 Volt	.20	.19	.18
EM404 / IN4004 400 Volt	.22	.21	.20
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Lge with Mtg. red	.45	.40
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161	Radio, TV and Electronics Data Book	.75
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MB8	1.8A	800	3.20	3.00
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PA40	8A	400	6.00	5.75
PA60	8A	600	6.75	6.50
PB40	25A	400	7.20	7.00

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CA 3028A	TO5	RCA Linear	3.00	2.80
LM 301A (UA 301A)	TO5	High input operational amp.	1.30	1.20
LM 309 (7805)	TO3	5 volt 1 amp regulator	4.20	4.00
LM 308 N	D.I.L.	Operational amp.	4.00	3.60
LM 381	D.I.L.	Dual operational amp	4.50	4.00
LM 709 (see UA709C)				
LM 741 (see UA741C)				
MC 1330P	D.I.L.	Homodyne IC	3.20	3.00
MC 1469R		½ amp voltage regulator	4.75	4.40
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NE 556	D.I.L.	Dual timer	2.75	2.50
NE 561B	D.I.L.	Phase Lock Loop IC	9.56	8.90
TAA 300	TO5	1 watt audio amp	2.90	2.70
TAA 521 Equiv. 709C				
TAA 840	D.I.L.	AM Radio tuner	3.20	3.00
TBA 221 Equiv. 741C				
TBA 281 Equiv. 723C				
UA 703C	TO5	RF.IF Amp	1.50	1.30
UA 709C (LM709)	TO3 or D.I.L.	General Purpose amp.	1.00	.95
UA 723C (LM723)	TO5	Regulator	1.50	1.40
UA 739C	D.I.L.	Dual OP amp. low noise	2.50	2.25
UA 741C	TO3 or D.I.L.	Operational amp.	1.20	1.10
OM 802			2.50	2.30

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A basic monitor for slow-scan television

Here is a new design for a monitor to display slow-scan TV pictures, of the type being transmitted by increasing numbers of radio amateurs. It uses four valves, four transistors, an IC and two SCRs, each performing the circuit functions for which they are best suited. This simplifies the unit and makes it easy to build, without sacrificing performance.

by IAN POGSON

Slow Scan TV, or SSTV for short, has become very popular in the United States and activity is beginning to quicken in this country as well. However, many Australian amateurs possibly do not realise just what a fascinating and absorbing branch of amateur radio is available to them, at quite a modest outlay in cost and equipment. Very little has been published in this country on the subject of SSTV and we propose to remedy that at least in some measure with the article to follow.

Without doubt, the best place to start in SSTV is with a monitor. Involving no more complexity than a modest CRO, a monitor can be used with the existing shack receiver, so that you can really "read the mail" of any amateur SSTV transmissions, either locally or from overseas. Equipment for the transmission of amateur SSTV signals is a little more involved and for the present at least, we will confine our efforts to describing a new monitor.

For those not yet familiar with SSTV, it is basically rather similar to conventional television except that the rate of scanning is slowed down from one picture every 1/25th of a second to approximately one every 8 seconds. This reduces the bandwidth required to transmit the signals from the usual 5MHz or so right down to a figure well within the audio spectrum. And as a result, SSTV signals can be transmitted and received using almost any of the established types of radio equipment, whether it employs AM, FM, SSB or other types of modulaton system.

Actually the SSTV "video" signal itself is not used to modulate the RF carrier directly. Because of the low scanning rate, the video is largely made up of very low-frequency components, and for these to be transmitted and received properly the transmitter and receiver would have to be fitted with much longer time constants than usual in the coupling circuits and other sections. To avoid this, the SSTV video signal is used to frequency modulate an audio subcarrier.

The subcarrier is made to vary between the limits of 1200Hz and 2300Hz. Synchronising pulses correspond with 1200Hz, black level is 1500Hz and white level is 2300Hz, with shades of grey in between black and white. Horizontal sync pulses have a duration of 5mS, with 30mS for vertical pulses.

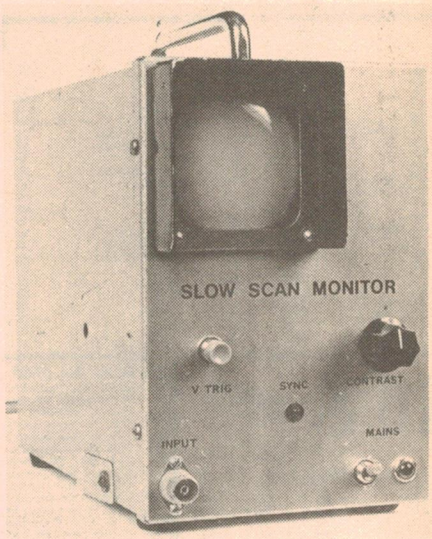
The number of scanning lines is 120. Due to the fact that the United States uses a 60Hz standard for their supply mains while we, with Britain and many other countries have a 50Hz standard, and as the mains frequency is used as a reference for synchronising pulses, a compromise has had to be struck. The result is a 15Hz sweep rate (60/4) for the US and a 16-2/3Hz sweep rate (50/3) for Australia, etc. To tie in with the set 120 horizontal lines, the vertical rate is 8 seconds and 7.2 seconds for 60Hz and 50Hz mains frequencies respectively.

The question may well be asked as to how this works out when an amateur in Australia is in SSTV contact with an amateur in the United States. In fact the differences in sweep rates are not very great and are well within the synchronising capabilities of the equipment involved. The pictures stay in lock, but the picture size will vary slightly.

Our approach to the design of an SSTV monitor has been along lines already established overseas. However, in order to encourage newcomers into this fascinating field, we have made some effort to simplify circuitry as much as possible, together with an eye to keeping costs down.

In line with the cost angle, we have made use of an oscilloscope which was described by Jamieson Rowe in May, 1966. In fact, the unit modified (or rather largely rebuilt) is the original prototype. There may be some readers who are in the same position, with one of these units which can form the basis of an SSTV monitor. Whether or not you are in this position, or whether you are starting from the beginning as it were, we wish to emphasise that the mechanical approach we used has been dictated by circumstances and is onlv intended as a guide for constructors. Apart from the usual precautions with the installation of a CRO tube with respect to magnetic fields, layout does not seem to be at all cirtical.

Let us turn our attention to the circuit diagram and go through it, discussing the various circuit functions. The frequency modulated SSTV subcarrier is fed to the input. This may be from a communications receiver, tape recorder, etc. To avoid excessive input to the 741 op-amp, a pair of 1N914A diode clippers are included. The signal is amplified by the op-amp and emerges as a square wave. In series with the output is an inductor, about 200mH, shunted by .022uF which tunes it to 2300Hz. This LC combination is the "video discriminator" and is effectively a rejector circuit at 2300Hz. The FM signal passing through the discriminator is effectively changed into an AM type signal, rather like the well established "slope detection" used in AM receivers for receiving FM signals.



This AM signal passes through a level or "contrast" control and is then amplified by TR1. The ouput at the collector is stepped up in voltage by the transformer, where it is detected in the bridge consisting of four silicon diodes. The video voltage from the detector is then fed directly between the cathode and grid of the cathode ray tube, where the beam is modulated to give shades of grey between black and white levels.

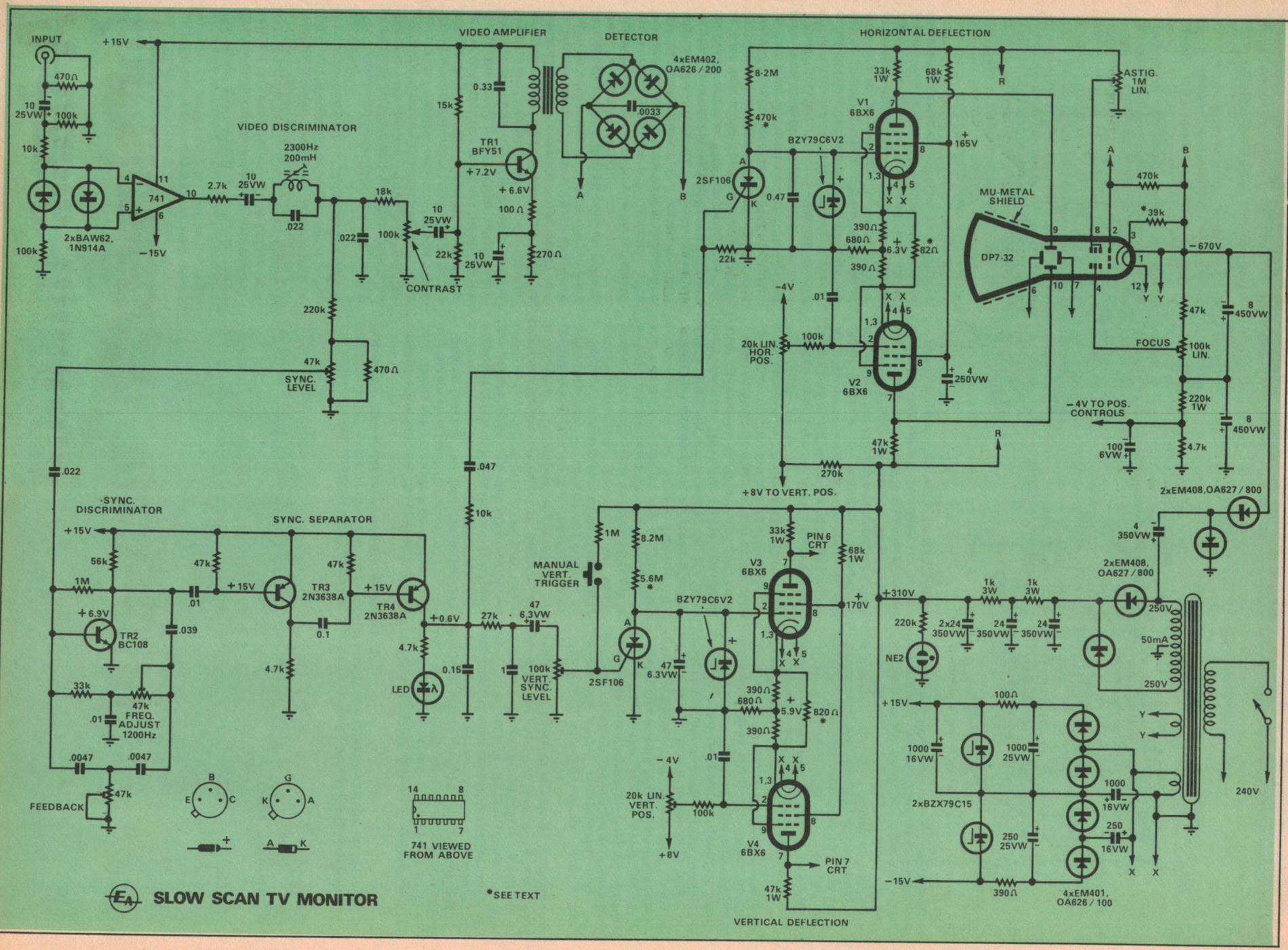
Returning now to the output of the video discriminator, a split is taken via a sync level control, to the sync discriminator. The level available from the video discriminator is quite high, much too high for our purpose and so the need for the 220k series resistor and the 470 ohm resistor shunting the 47k potentiometer.

The sync discriminator is, in effect, a frequency conscious amplifier, using a twin-T network and peaked to the sync frequency of 1200Hz. This circuit was selected in preference to an LC circuit similar to the video discriminator because a fairly high Q circuit is required and readily available coils did not come up to this requirement.

Following the sync discriminator is a two-stage sync separator using TR3 and TR4. In the collector of TR4 is a light emitting diode, which blinks on every sync pulse and is very useful for adjustment purposes. Sync pulses appear across the 0.15uF capacitor and are fed via a 10k isolating resistor to the gate of the SCR in the horizontal deflection circuit.

The 30ms-long vertical sync pulses are a little tricky to separate out cleanly, but by using the two-stage sync separator, an

Above is a picture of our SSTV monitor and the full circuit details are shown on the opposite page.


INPUT
+15V
VIDEO AMPLIFIER
DETECTOR
HORIZONTAL DEFLECTION
VIDEO DISCRIMINATOR
2300Hz
200mH
TR1
BFY51
+7.2V
+6.6V
4xEM402,
OA626/200
.0033
8·2M
33k
1W
68k
1W
R
ASTIG.
1M
LIN.
V1
6BX6
BZY79C6V2
+165V
2SF106
MU-METAL
SHIELD
DP7-32
470k
*39k
-670V
FOCUS
100k
LIN.
47k
8
450VW
220k
1W
4.7k
-4V TO POS.
CONTROLS
100
6VW
47k
1W
270k
+8V TO VERT. POS.
20k LIN
HOR.
POS.
100k
V2
6BX6
4
250VW
-4V
.01
390Ω
680Ω
6.3V
82Ω
390Ω
22k
2xBAW62,
1N914A
741
-15V
2.7k
10
25VW
.022
18k
100k
CONTRAST
22k
270Ω
100Ω
15k
0.33
220k
47k
SYNC.
LEVEL
470Ω
.047
10k
SYNC.
DISCRIMINATOR
SYNC. SEPARATOR
56k
1M
+6.9V
TR2
BC108
.039
33k
47k
FREQ.
ADJUST
1200Hz
.0047
FEEDBACK
TR3
2N3638A
TR4
2N3638A
0.1
4.7k
+0.6V
27k
47
6.3VW
0.15
LED
100k
VERT.
SYNC.
LEVEL
MANUAL
VERT.
TRIGGER
1M
8.2M
5.6M
V3
6BX6
PIN 6
CRT
170V
47
6.3VW
2SF106
BZY79C6V2
390Ω
680Ω
5.9V
820Ω
20k LIN.
VERT.
POS.
100k
V4
6BX6
PIN 7
CRT
47k
1W
+8V
-4V
VERTICAL DEFLECTION
+310V
1k
3W
1k
3W
2x24
350VW
24
350VW
24
350VW
220k
NE2
2xEM408,OA627/800
4
350VW
2xEM408,
OA627/800
250V
50mA
240V
100Ω
1000
16VW
1000
25VW
2xBZX79C15
250
25VW
1000
16VW
250
16VW
4xEM401,
OA626/100
390Ω
-15V
X X
Y Y
741 VIEWED
FROM ABOVE
*SEE TEXT
SLOW SCAN TV MONITOR

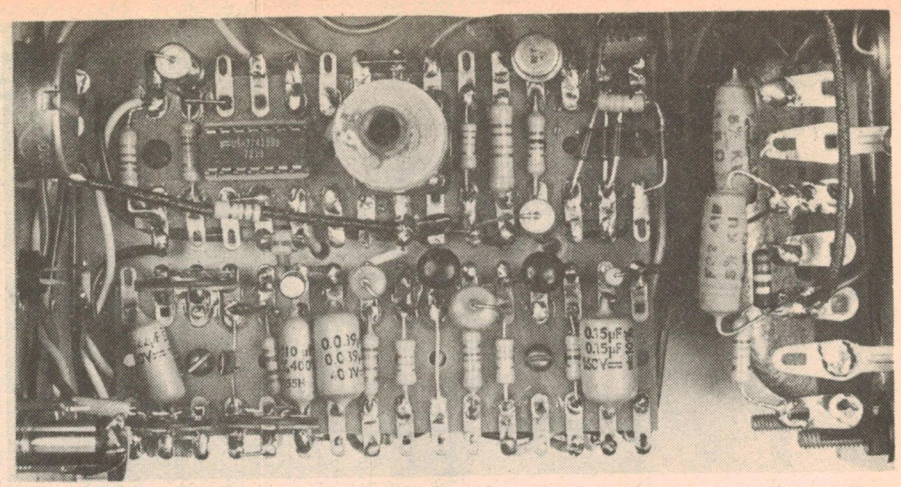
integrator consisting of the 27k resistor and 1uF capacitor, together with a vertical sync level control, very successful vertical synchronising has been achieved. The vertical sync pulses are fed into the gate of the SCR of the vertical deflection circuit.

As the vertical sweep rate is very slow, between 7.2 and 8 seconds, it often happens that when receiving a transmitted picture, you have just missed a vertical pulse. This would normally mean that you have to wait a very considerable time before you start to get the next picture. To avoid this, it is fairly standard practice to include a manual vertical triggering button. This is simply a 1M resistor from the high tension in series with a "make" press button on the front panel.

The sawtooth generators are perhaps of more than just passing interest. The simplicity is such that it is difficult to imagine anything simpler. Fundamentally, the generator consists of a resistor and capacitor time constant, with an SCR to initiate flyback. The sawtooth appearing across the capacitor is DC connected to the grid of the relevant deflection valve. There are only two extra components additional to those already mentioned. A 22k resistor from the gate of the horizontal SCR to ground is added to ensure a reasonably low impedance so that there is less likelihood of spurious triggering, while 6.2V zener diodes are used to limit the maximum voltage across each capacitor.

The foregoing describes both horizontal and vertical generators in principle. The horizontal circuit has an 8.2M resistor and a 470k in series with a 0.47uF capacitor. The 470k resistor may have to be modified during adjustment but more will be said about that later on. The vertical circuit has an 8.2M and a 5.6M in series with a 47uF tantalum capacitor. Instead of the 22k resistor from the gate of the SCR to ground, the in-circuit resistance of the 100k vertical sync level control is substituted.

Each deflection circuit consists of two 6BX6 valves in a "long-tail pair." Direct coupling from the valve plates permits the use of amplified trace positioning. This is achieved by an adjustable voltage via a potentiometer to the undriven grid of each pair. The grid is bypassed for signal frequencies with a .01uF capacitor. Gain of the stage and so sweep size, is controlled with a resistor between the cathodes of each pair. These are set during adjustment and will be covered later in detail.



The strip at the top contains the IC amplifier, discriminator coil, video amplifier and detector. The strip below contains the sync discriminator and sync separator circuits. At the right is part of the power transformer and supply wiring.

Before leaving the two deflection amplifiers, it may be seen that the horizontal amplifier has a 4uF electrolytic bypassing the screen grids. On the other hand, no bypass is included in the vertical stage screens. To be effective at such a low frequency, the capacitance would be prohibitively large. Happily the stage works quite satisfactorily without any bypass.

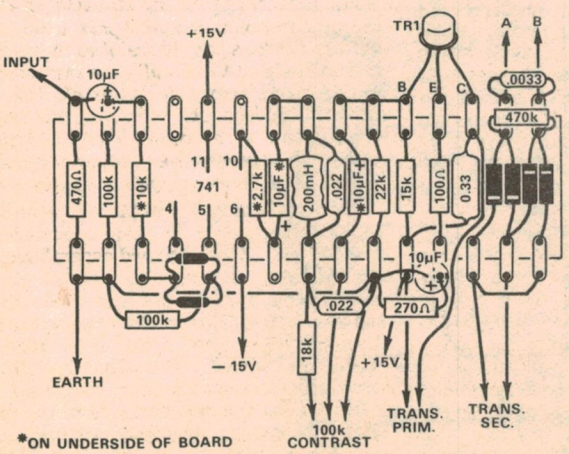
The power supply system is of necessity rather complex. However, we have managed to simplify it as much as possible and only one transformer is involved. There are two 6.3V windings, one for the CRT heater while the other supplies the deflection valve heaters, together with the plus and minus 15V supplies for the solid state circuits. These use voltage doubling, with the output stabilised by 15V zener diodes. Additional filtering was found to be necessary on the positive rail and this is provided with a 1000uF electrolytic across the output.

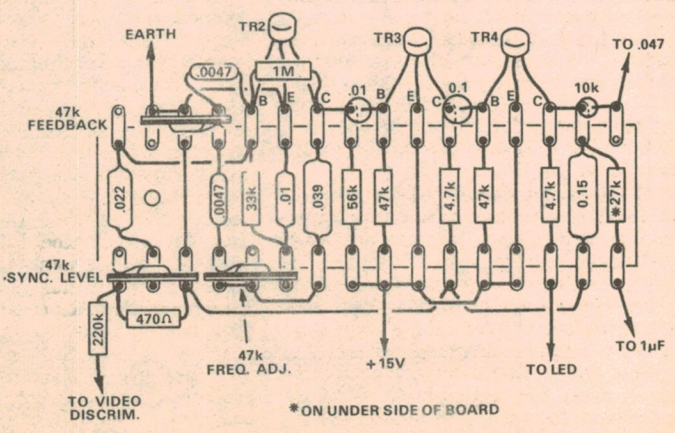
High tension for the deflection amplifiers is obtained by full wave rectification from a 250-0-250 volts secondary winding. It was found that a considerable amount of filtering of the HT line was necessary. This is achieved with a two-stage filter, making use of four 24uF 350VW capacitors in one can, with two 1k 3W resistors.

EHT of nearly 700 volts is obtained by voltage doubling from one side of the HT winding. The output capacitor consists of two 8uF 450VW units in series. The DC voltage across each unit is established by connecting their junction to the junction of the 100k focusing pot and the 220k resistor of the EHT voltage divider chain. A 39k resistor between the cathode of the CRT and the EHT rail sets the brightness level, and may need adjustment during final setting up.

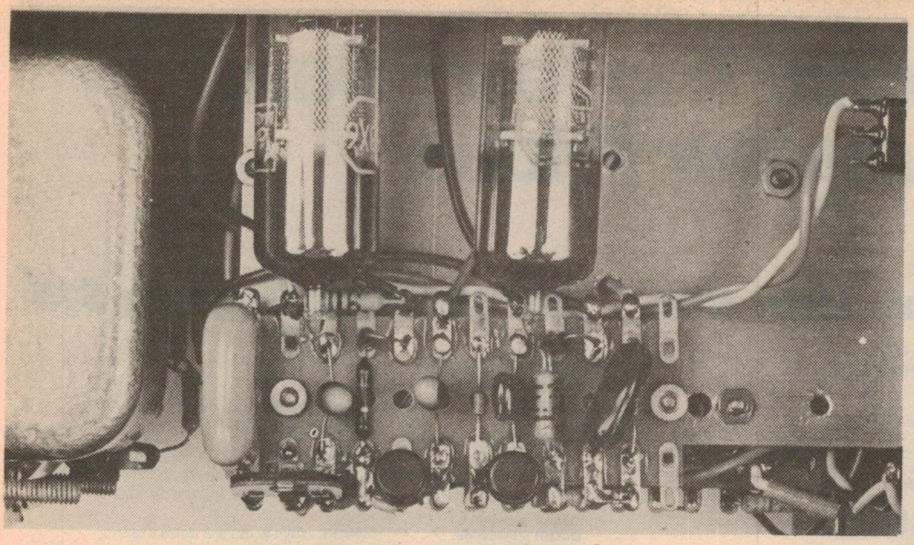
So much for the circuit. Now a few comments about components may be helpful. As mentioned earlier, our prototype is a much rebuilt 1966 3in Oscilloscope and as such, uses the original metalwork. The only change of note, is that a new front panel overlay was needed. If you wish to make your unit up as we have, then a set of metalwork for the 1966 CRO would be suitable, with the need for the new panel overlay. More than likely readers will have their own ideas about this and a suitable panel could be made up from a piece of aluminium.

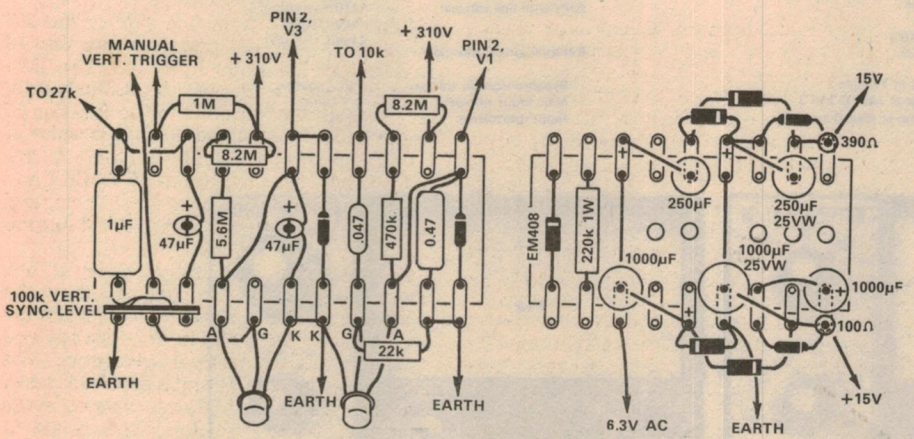
Resistors and potentiometers should present no problems. The capacitors should all be available, with one possible exception. The can type housing four 24uF 350VW units may be difficult to obtain but substitutes in the form of separate capacitors should be easy enough to obtain. The capacitors which we used are either electrolytics or polycarbonates, with two exceptions. They are the two 47uF, 6.3VW





At the left is the wiring diagram for the board with the IC, discriminator, video amplifier and detector. At the right is the wiring diagram for the sync discriminator and sync separator circuits. Care should be taken wiring the detector as high voltage appears here.





The picture at the top shows a close-up of the vertical and horizontal sweep generators, with the inverted vertical amplifier valves. Below are wiring diagrams for the two sweep generators and the low voltage power supplies.

tantalums. Diodes should present no problems. Either the types specified or their equivalents may be used. The only possible exception is the LED. This may be any small ruby coloured unit, with a bezel for mounting it on the front panel. A wide variety of suitable LEDs are currently available.

The two SCRs which we used are made by ITT but any low power SCR should be quite suitable; the circuit is quite undemanding. Similarly the 741 IC comes in various makes and packages. The one we used is in a 14-pin dual-in-line package but no trouble should be experienced in adapting almost any mechanical arrangement. The transistors, of which there are only four, are all readily available. However, if substitution of the BFY51 video amplifier is considered, care should be taken to make sure that the substitute will do the job.

The 6BX6 valves should still be readily available but if you have some other types on hand, then they may be used provided they will do the job. The pentode section of a 6BL8 is quite satisfactory and we imagine that other types such as 6AU6, 6AM6, etc would be satisfactory. The CRT is special in that it has a long persistence phosphor. We understand that Elcoma have stocks sufficient to meet the anticipated demand. When ordering the tube, a mu-metal shield type No 55530 may be ordered at the same time. The orange perspex filter which we fitted, although not essential, does seem to help to give a better picture. Pieces of suitable material should be available from suppliers who have prepared kits for digital projects, such as our digital frequency meter.

The 200mH adjustable inductor used for the video discriminator has been made available by Transcap Pty Ltd. Stocks should be available through your local supplier but if any difficulty is experienced, stocks should be available from Watkin Wynne Pty Ltd, 32 Falcon Street Crows Nest, NSW, 2065.

The small transformer feeding the detector is actually a miniature 240 / 12.6V heater transformer. We used a Ferguson type PF2851 but any small transformer with about the same turns ratio should be satisfactory. The mains transformer is not quite so easy as this particular type is no longer in production. As the demand for the transformer for this project is likely to be rather limited (we could be wrong!) we hesitated to suggest that manufacturers make up further stocks. However, the type of reader who is likely to make up one of these slow scan monitors is also likely to have a transformer of similar specs in his junk box. It may be necessary to add a shorting strap to reduce the stray field. In any case, we feel that we can leave this problem for each individual to solve in his own way.

Another small point on the same less optimistic note relates to miniature tag board, which we have used on this unit and many others in the past. We are advised that this material is going off the market. However, a new product has already appeared which should be quite a satisfactory substitute. Instead of a strip with lugs eyeleted each side it is a printed board of about the same total width, and provides copper pads in lieu of the lugs. In short, this item should substitute quite well for the former product.

From the constructional point of view, we will assume that readers will be following the method which we used. Any deviations can safely be left to the individual to sort out for himself. We will also assume that you have a suitable set of metalwork.

A good place to start is with the sub-assemblies. There are five main boards, each with components mounted on miniature tag board and we have given wiring diagrams to make the job somewhat easier than if you had to work it all out for yourself.

One board includes the signal input, IC op amp, video discriminator, video amplifier and detector. The detector transformer is mounted separately. It is straightforward except for the IC and the 200mH coil. We used a socket for the IC and we snipped off all the unused lugs. With the socket correctly located on the board, we drilled five small holes corresponding to pin positions 4, 5, 6, 10 and 11. The socket is located in these holes and the lugs are connected to the tagstrip as indicated, by means of thin tinned copper wire. Before mounting the 200mH coil, carefully cut off the extreme end at the moulded shoulder. Cut off all four corner lugs and bend the remaining two active lugs out at right angles for soldering to the appropriate lugs on the board.

The board containing the sync discriminator and sync separator presents no problems. The trimpots are mounted vertically and it may be seen that in common with the other boards, some resistors and capacitors are also mounted vertically to save space. For the same reason some items are mounted underneath the board.

The board containing the two sawtooth generators and the board carrying most of the small components for the two deflection amplifiers are quite straightforward. The last board, which mainly includes components for the two 15 volt supplies is rather crowded and needs some care in fitting the electrolytics. Two pairs of lugs at one end carry a 220k 1W resistor and an 800 PIV diode. These belong to the CRT EHT circuit.

The pictures show the location of all the major components and apart from a few details readers should be able to assemble the unit without difficulty. In our case, the power transformer is stood off the back skirt of the chassis with four spacers. A small panel of aluminium is fixed to one side of the transformer to accommodate a couple of tagstrips for power supply wiring.

A vertical panel, about 11cm long and 8cm wide, is fixed below the main chassis and on it are mounted three board assemblies. The one including the input to detector circuits is mounted nearest the underside of the chassis, with the board containing the sync discriminator and sync separator immediately below. The board with the sawtooth generators is mounted immediately on the opposite side of the panel. With the boards in these positions, it is possible to get to all the adjustments without hindrance.

The board with the deflection circuit components is mounted atop the chassis.

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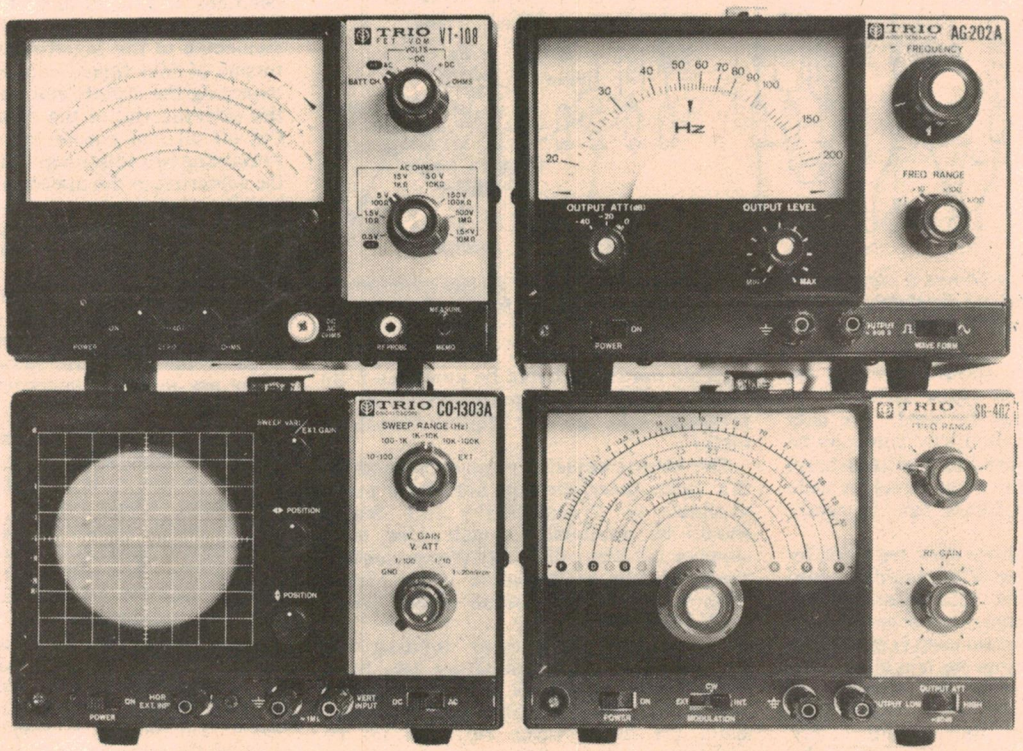
VT108FET Volt-Ohm-Meter $68*

DC volt meter:	
Range:	0.5 to 1,500 V in 8 ranges.
Input impedance:	11 MΩ on each range.
Accuracy:	±3% at full scale
AC volt meter:	
Range (Sine wave voltage):	1.5 to 1,500 V r.m.s. full scale in 7 ranges
(dB):	−15 to +66 dBm
(Any other voltage):	4.2 to 4,200 Vp-p full scale in 7 ranges
Input impedance:	1 MΩ 80 pF at 500 to 1,500 V range 145 pF at 1.5 to 150 V range using (PC-14) probe
Accuracy:	±5% at full scale
Freq. response:	15 Hz to 5 MHz ±10% 30 Hz to 2 MHz ±3%
Ohm meter	
Range:	0.1 Ω to 1,000 MΩ in 7 ranges.
Accuracy:	±5% of setting range at scale 0.3 to 3 ±10% of setting range at scale 0.1 to 10
Memory	
1% scale variation:	Approx. 30 sec.

AG202A AudioGenerator $75*

Frequency range:	20 Hz to 200 kHz in 4 ranges
Freq. accuracy:	±(3% + 2 Hz)
Sine wave characteristics:	
Output voltage:	10 V r.m.s. ±10%
Distortion:	0.5% at 50 Hz to 100 kHz 1% at 20 Hz to 200 kHz
Square wave characteristics:	
Output voltage:	10 Vp-p
Overshoot:	3%
Sag:	10% at 20 Hz
Output impedance:	600 Ω
Output attenuation:	HIGH/LOW (40 dB) and variable control
Drift with line voltage:	(±10% variation) Freq: ±0.5% Level: ±0.5 dB
External synchronization:	
Synchronization voltage:	1%/V approx.
Max. input voltage:	3 V r.m.s.
Input impedance:	10 kΩ



CO1303A 75mm Scope $135*

CRT:	C308P1
Vertical Sensitivity:	20 mV/cm
Attenuator:	1/1, 1/10, 1/100 plus fine control.
Bandwidth	DC: DC to 1,5 MHz (−3 dB) AC: 2 Hz to 1,5 MHz (−3 dB)
Input R and C:	1 MΩ, 30 pF
Max. input voltage:	300 V (DC + AC peak) or 600 V p-p
Horizontal Sensitivity:	500 mV/cm
Attenuator:	Continuously variable
Freq. response:	DC to 250 kHz
Input R and C:	1 MΩ, 40 pF
Sweep Freq:	10 Hz to 100 kHz in 4 ranges
Synchronization:	Internal (−)
Power requirements:	100/117/230 V AC 50/60 Hz. 15 W.

SG402 R.F. Generator $60*

Freq. range:	100 kHz to 30 MHz in 6 ranges
Freq. accuracy:	±1%
Output Voltage:	0.1 V r.m.s.
Attenuator:	HIGH/LOW (10:1) and variable control.
Modulation:	
Internal:	400 Hz, 40% mod. degree
External:	Requires 1.5 V r.m.s. for 40% mod. degree
Power requirements:	100/117/230 V AC 50/60 Hz. 6 W.
Dimensions:	W 186 mm x H 131 mm x D 220 mm (W 190 mm x H 154 mm x D 245 mm Max. dimensions)
Weight:	2.5 kg

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SSTV MONITOR

The horizontal deflection valves are those above the chassis and the vertical deflection valves are mounted upside down on the other side of the chassis. The detector transformer is above the chassis between the horizontal valves and the front panel. Focusing and astigmatism potentiometers are mounted on a bracket above and at the rear of the chassis and the horizontal and vertical shift controls are immediately below and mounted on the back skirt of the chassis.

The power supply board is mounted immediately behind the CRT socket and the board is stood off the chassis by a cm or so to clear any components mounted under the board. This also applies to all the other boards. If you are not using a can type multiple electrolytic assembly, then some ingenuity may be needed to fit the substitutes in the space available.

Apart from the tube face, with its hood and filter, the only other items on the front panel are the input socket, trigger and mains switch, LED and mains indicator lamps and contrast control. The panel is held in place by the trigger switch and contrast control.

Having built the SSTV Monitor, the next task is to put it into operation. Some suggestions as to how to go about this are added. Although it is not necessary in most cases, we stress that the 700 volts of EHT and the 300 volts HT line can be dangerous, particularly as the source impedance is quite low in each case. Apart from the more obvious danger points, the detector components which at first sight seem innocent enough, are in the EHT circuit and a bite from this is not recommended.

Before switching on for the first time, it is always wise to make a thorough check of wiring to make sure that there are no errors or omissions. Having done this, a helpful

(Continued on page 94)

LIST OF PARTS

1 Case, 12.7cm wide x 19cm high x 21.6cm deep, with front panel and chassis
1 Carrying handle
4 Rubber feet
1 Set of brackets, including tube hood and support ring
1 Perspex orange filter
1 Power transformer, 240V primary, 250V- 0-250V secondary at 50mA, 6.3V at 1A, 6.3V at 3A, low radiation type (see text)
1 Miniature detector transformer, 240V primary, 12.6V at 150mA (PF2851 or similar)
1 200mH variable inductor (Transcap)
1 Coaxial input socket
1 CRT socket
4 9-pin miniature valve sockets
1 Miniature toggle switch, SPDT
1 Miniature press-on switch, SPDT
1 Knob
1 NE-2 neon bulb, in pilot bezel
1 Rubber grommet, ⅜in
1 Rubber grommet, ¾in
2 7-lug tagstrips
1 3-lug tagstrip
2 Miniature tag boards with 16 prs tags
1 Miniature tag board with 15 prs tags
1 Miniature tag board with 12 prs tags
1 Miniature tag board with 9 prs tags
2 Diodes, BAW62, 1N914A
4 Diodes, EM401, OA626 / 100
4 Diodes, EM402, OA626 / 200
4 Diodes, EM408, OA627 / 800
2 Zener diodes, BZY79 6V2
2 Zener diodes, BZX79 C15
2 SCR, 2SF106 or similar
1 LED (see text)
1 IC, 741
1 Transistor, BFY51
1 Transistor, BC108
2 Transistors, 2N3638A
1 Neon indicator, NE-2
4 Valves, 6BX6
1 CRT, DP7-32, with mu-metal shield type 55530

CAPACITORS
1 .0033uF 100V polycarbonate
2 .0047uF 100V polycarbonate
5 .01uF 100V polycarbonate
3 .022uF 100V polycarbonate
1 .039uF 100V polycarbonate
1 0.15uF 50V polycarbonate
1 0.33uF 50V polycarbonate
1 0.47uF 50V polycarbonate
1 1uF 50V polycarbonate
1 4uF 250VW electrolytic
1 4uF 350VW electrolytic
2 8uF 450VW electrolytics
4 10uF 25VW electrolytics
4 24uF 350VW electrolytics (in one can)
2 47uF 6.3VW tantalums
1 100uF 6VW electrolytic
1 250uF 16VW electrolytic
1 250uF 25VW electrolytic
2 1000uF 16VW electrolytics
1 1000uF 25VW electrolytic

RESISTORS (½W unless stated otherwise)

1 82 ohms	*2 33k 1W*
2 100 ohms	*1 33k*
1 270 ohms	*1 39k*
5 390 ohms	*3 47k*
2 470 ohms	*2 47k 1W*
2 680 ohms	*1 56k*
1 820 ohms	*2 68k 1W*
2 1k 3W	*4 100k*
1 2.7k	*2 220k*
3 4.7k	*1 220k 1W*
2 10k	*1 270k*
1 15k	*2 470k*
1 18k	*2 1M*
2 22k	*1 5.6M*
1 27k	*2 8.2M*

2 20k linear potentiometers
3 47k linear trimpots
2 100k linear potentiometers
1 100k linear trimpot
1 1M linear potentiometer

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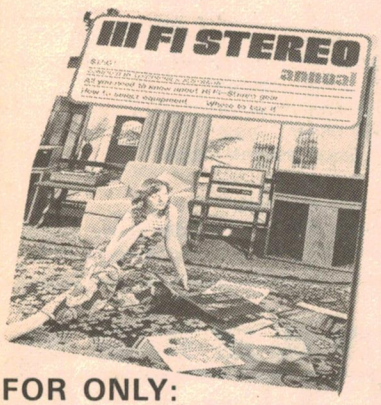

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Musical octave note synthesiser

Using low cost digital ICs, it is now possible to derive each of the twelve semitones of an octave in the equal temperament musical scale from a single reference frequency source. This article describes a basic synthesiser circuit using readily available devices.

by STEPHEN H. DOLDING*

The equal temperament scale consists of twelve semitones each progressing by the 12th root of two, or in the ratio of 1:1.05946, giving a ratio of exactly 1:2 for the complete octave. If the frequency of each semitone can be generated precisely in the required ratio by selecting a suitable reference frequency and twelve related fixed division factors, then the semitones will all remain precisely in tune with one another, even if the reference frequency should drift.

It can be shown that if the integral-number division factors given in Fig 1 are chosen, then the individual output frequencies are in the correct ratios to one another, within the acceptable accuracy of ± 0.1 pc. When practical division circuits are used, the factors must be integers, and the values chosen are the smallest that will give the correct ratios within the required accuracy.

In order to be tuned to the standard international pitch of A - 440Hz, F ref must be equal to 440 x 284, ie, 124,960Hz. In practice a frequency of 125kHz may be used with errors of less than 0.03pc.

As shown in Fig 2 an alternative is to use a reference of 1MHz with additional binary circuits after the dividers. This then provides outputs for other octaves as required. If higher pitches are required the reference frequency may be changed to 2 or 4MHz.

For monophonic instruments a single programmable divider system may be used, the division factor being set according to the key which is selected. This system is implemented by using three programmable decade counters, the division factor being set by a "read-only memory" consisting of a diode matrix, as shown in Fig 4.

The decade counters are upward counting and the data inputs are "loaded" or preset to the "1000 Complement" of the required division factor by means of an input code in BCD form, eg, if the division factor required is 284, the counter is preset to 716 (ie, 1000 — 284). After 284 input pulses from the reference oscillator the counter reaches 1000. At this point a load pulse is generated, which presets the counter to 716 again. Hence an output pulse is obtained after every 284 pulses from the reference oscillator (ie division by a factor of 284).

Fig 3 shows a table of the required division factors, preset counts and BCD codes to be used. Note that C3 is always a binary 1 and D3 is always binary 0, so that these data inputs do not need to be changed.

Fig 4 ahows the circuit diagram for a monophonic system. Additional binary

* "Stables", 21 Granville Road, Tunbridge Wells, Kent TN1, 2NU England.

Component List

IC1 SN7413N
IC2, 3, 4 SN74176N (Alternatives SN 74196N, 8280, or 290)
IC5, 6 SN7404N
IC7 SN7493N
R1 330 ohms ½W 1pc
R2 150 ohms ½W 1pc
R3 100 ohms ½W 5pc
VR1 100 ohms WW ½W
C1 2,200 pF
C2 500 pF, D1 — D52 IS940 (or similar general purpose)

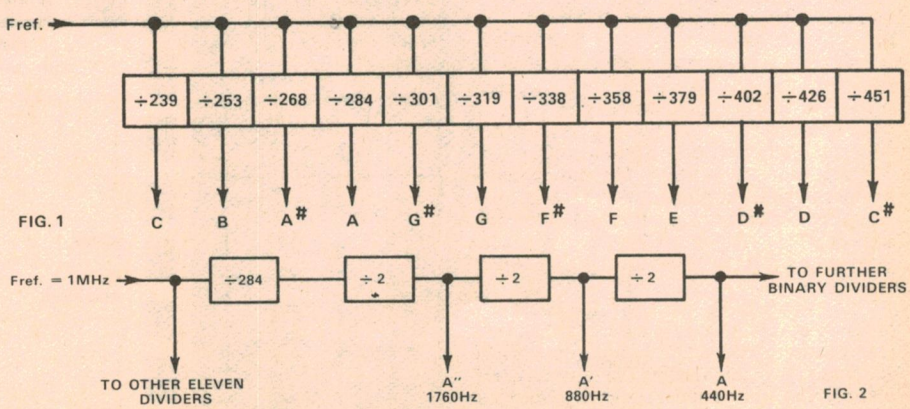
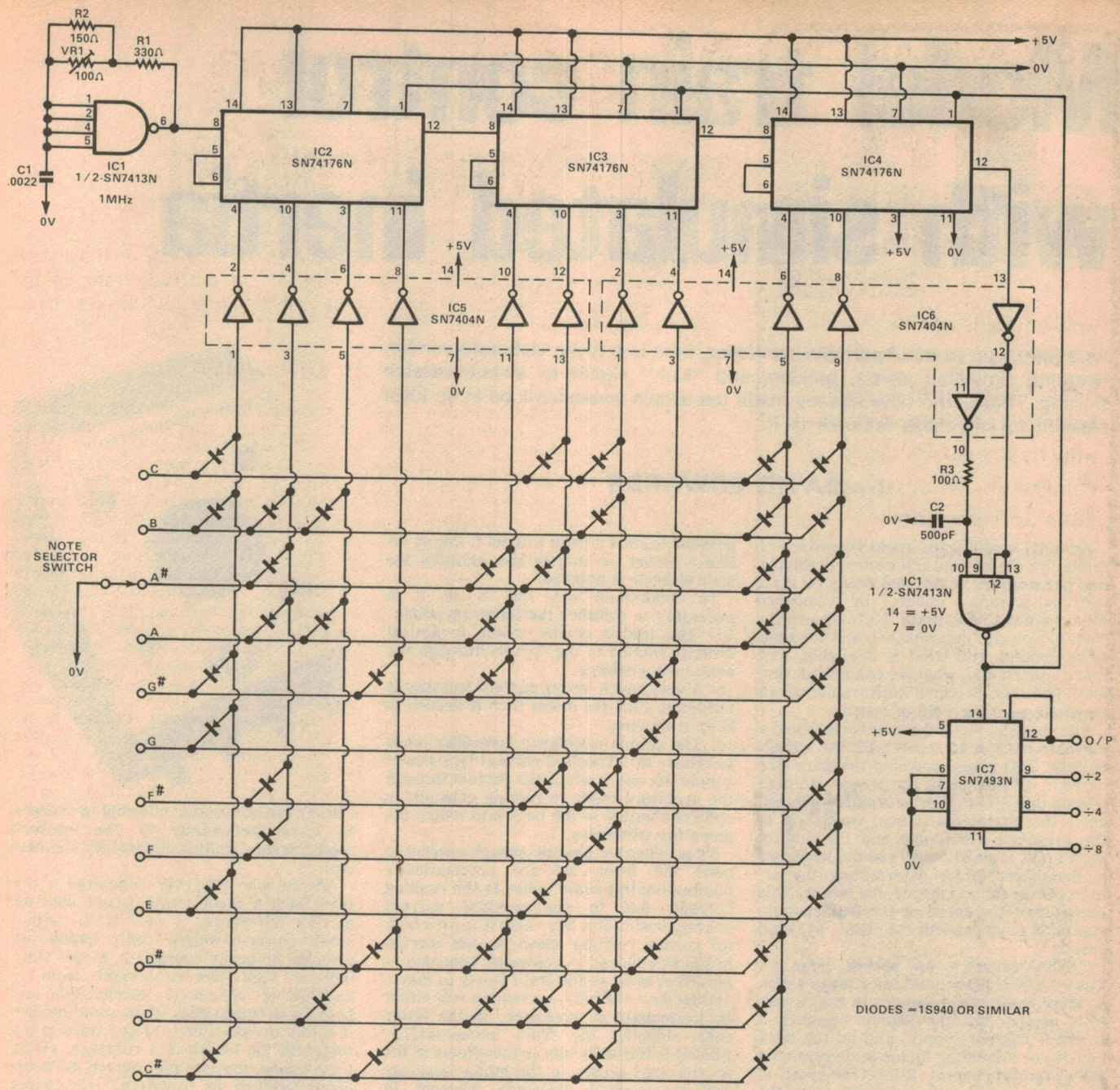


FIG. 1

FIG. 2

The upper diagram above shows the way in which the twelve notes of the tempered musical octave may be derived from a single reference frequency, while the lower diagram shows how further binary dividers may be used on each note to generate the lower octaves.



dividers may be added to obtain lower pitches if required.

A full polyphonic system could be constructed using twelve such circuits all driven from a common reference frequency. In this configuration the diode matrix would not be required, the data inputs to the dividers being permanently connected to 0 or 1 according to the BCD code for the required division factors.

The author has used the monophonic system described above as the basis for a reference source for tuning electronic organs. This may be used as a precision reference if a 1MHz crystal oscillator is used as the source.

This circuit could also form the basis of a programmable musical box controlled by a ring counter. Other special effects can be generated by modulating or suitably adjusting the reference frequency and, of course, by adjusting the reference frequency any instrument making use of this circuit can be tuned to any other instrument by means of a single adjustment.

Above is the complete circuit of the programmable divider unit developed by the author using readily available TTL digital ICs. It will generate any one of the 12 notes of the musical octave, and its suboctaves. Twelve such dividers would be needed if the notes are required simultaneously, as in a polyphonic electronic organ, although the diode matrix would no longer be needed. Below is a chart (Fig 3) showing the divider constants.

NOTE	DIVISION FACTOR	PRESET COUNT	BCD CODE FOR DIVIDER DATA INPUTS											
			A1	B1	C1	D1	A2	B2	C2	D2	A3	B3	C3	D3
C	239	761	1	0	0	0	0	1	1	0	1	1	1	0
B	253	747	1	1	1	0	0	0	1	0	1	1	1	0
A-shp	268	732	0	1	0	0	1	1	0	0	1	1	1	0
A	284	716	0	1	1	0	1	0	0	0	1	1	1	0
G-shp	301	699	1	0	0	1	1	0	0	1	0	1	1	0
G	319	681	1	0	0	0	0	0	0	1	0	1	1	0
F-shp	338	662	0	1	0	0	0	1	1	0	0	1	1	0
F	358	642	0	1	0	0	0	0	1	0	0	1	1	0
E	379	621	1	0	0	0	0	1	0	0	0	1	1	0
D-shp	402	598	0	0	0	1	1	0	0	1	1	0	1	0
D	426	574	0	0	1	0	1	1	1	0	1	0	1	0
C-shp	451	549	1	0	0	1	0	0	1	0	1	0	1	0

Model train control with simulated inertia

As a follow up to our April train controller, here is a more elaborate version featuring simulated inertia, braking, and "kick" circuit to ensure reliable starting. Those who have already made the simple version will be in an ideal position to add these features to it.

by DAVID EDWARDS

An ideal model train would reproduce in miniature all the characteristics, problems and peculiarities of the real thing, be it an old coal-burning "Rocket" or a modern diesel-electric ore-train. Unfortunately, such models are unrealisable, and we have to be content with what is available, and more importantly, what we can afford. One area, however, in which improvements can be made is in the field of control.

The simplest method of control is to use a variable resistor in series with the supply voltage. This gives control of the armature current, and hence of the torque. At high speeds this gives quite acceptable control, since the circuit resistance, consisting of the armature resistance and the control resistance, is quite small, and the back emf is the major factor determining the armature current and, hence, the torque. This means that the speed of the train is substantially independent of load at high speeds.

Trouble occurs at low speeds, however. The control resistor is set for a large value, so there is a large resistance in the circuit. This means that the supply becomes a constant current supply, and so the back emf is not the major factor in determining the armature current. Hence the speed of the train varies quite markedly with the load, often stalling on gradients and curves.

Probably the most objectional feature of the simple resistance controller is its poor starting characteristics. It is almost impossible to start a train without it taking off like a rocket, no matter how skilfully the control knob is handled.

To understand why this is so, it is necessary to consider the following points:
(a) The torque of the motor is almost directly related to the current through the armature windings.
(b) A very much larger current (torque) is needed to start the motor than is needed to keep it moving.
(c) The simple resistance controller tends to behave as a constant current type power supply; ie, one in which the current through the armature tends to remain constant in spite of changes in the back emf which the armature generates.

Thus, when we provide enough current to start the train, we are automatically nominating this same value as the running current, due to the constant current characteristic. But this value is far too high for normal running speed, so the current has to be reduced — controller retarded — almost as soon as the train starts to move. Unless done skilfully, correction will either be inadequate or excessive; in the latter case stopping the train unnecessarily. Adding to this difficulty is the effects of the friction that occurs in the motor bearings and the contact problems inherent in transfering power from the rails to the train.

This is where the controller described in the April issue scores. It has a constant voltage characteristic, allowing the current to vary according to the motor's requirements, and as dictated by the back emf.

Anyone who has ever compared a real train with a model train would note one glaring difference. A real train, with a small power-to-weight ratio, cannot accelerate or brake rapidly. A model train, with a high power-to-weight ratio, is capable of ridiculous acceleration and braking performances. With some models, it is literally possible to stop a train in less than half the length of a carriage. (When this is done, mutters can usually be heard about firemen in fireboxes!) Of course, inertia can be simulated by being less heavy-handed on the throttle, but this technique is not suitable for automatic signalling systems, where trains have to be

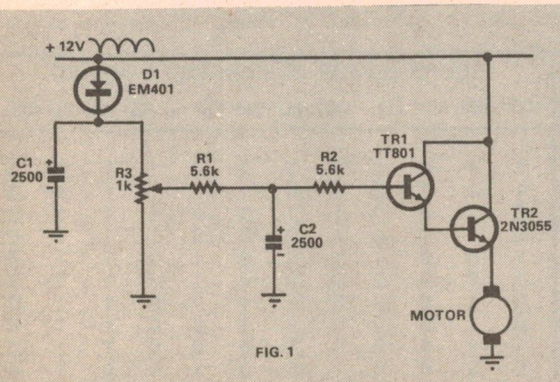


FIG. 1

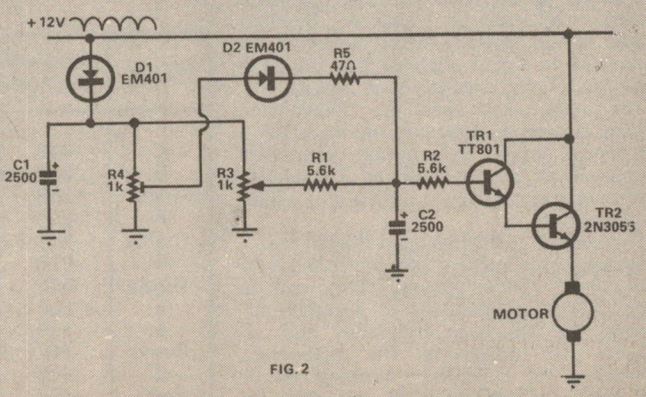


FIG. 2

These two simple circuits are quite practical, and may be built as the first step towards our final circuit.

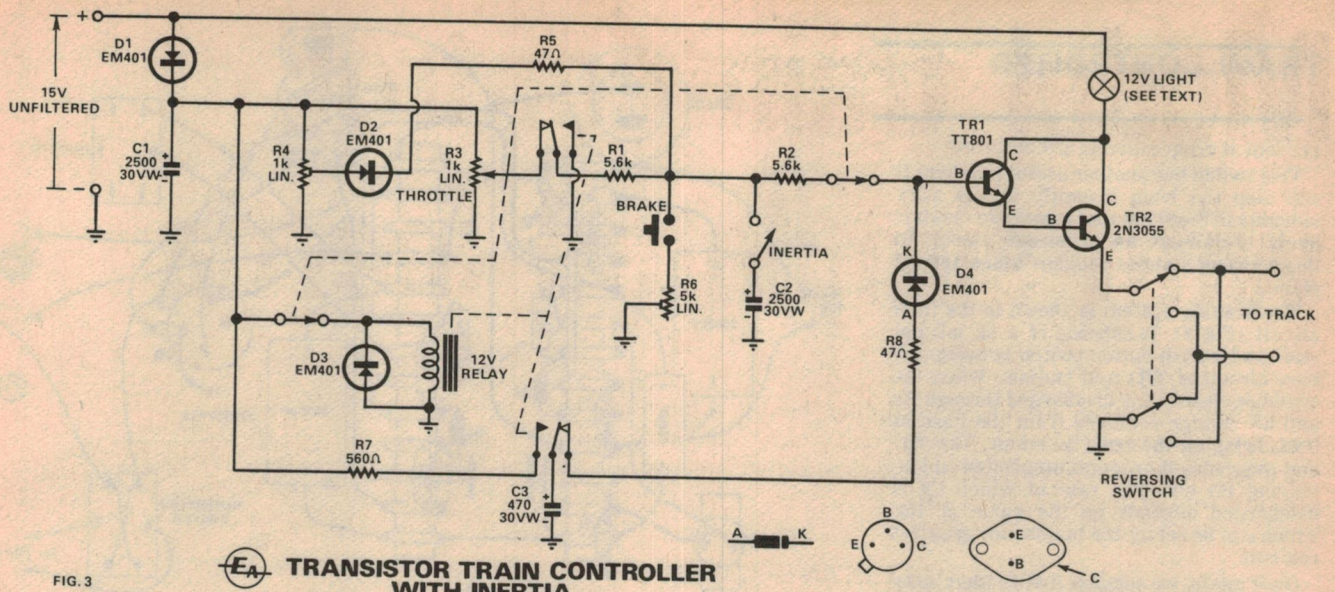


FIG. 3

TRANSISTOR TRAIN CONTROLLER WITH INERTIA

started and stopped automatically. What is obviously required is artificial inertia.

The problems and requirements just outlined inspired our new controller. The circuit is based on the Darlignton pair emitter follower circuit described in the April issue, to which we have added several features. The main one is the artificial inertia, the others being aimed mainly at getting the maximum benefit from the inertia circuit.

The inertia circuit itself can be switched out if required, since it has been found that precise shunting manoeuvres are sometimes more easily performed without it. The circuit has such good low speed characteristics that the operator can easily provide a realistic performance in these circumstances.

In conjunction with the inertia circuit we have a brake circuit. This provides added realism, in that the train may be allowed to simply coast after power is switched off, or brought to a stop more rapidly by applying the brake. While our circuit uses a simple push button, giving a fixed degree of braking, it would be possible to substitute a pot to give variable braking. Such a pot would have to be spring loaded.

The inertia and braking circuits can be operated from signalling circuits so that a train will reduce speed gradually when approaching a signal which is against it and stop at the signal until the latter changes. It will then accelerate slowly and eventually resume its normal speed.

Finally, there is what we have dubbed the "kick in the pants" circuit. One of the most annoying situations is that where a train that will not start when a normal starting voltage is applied to the tracks. At best, it will not start until a lot more voltage is applied, at which point it will start with a violent jerk. At worst it will not start at all, meaning that it has to be pushed with the finger and the whole illusion destroyed.

One obvious cause of this problem is poor contact between the rails and loco wheels, but there appear to be more subtle causes. To quote just one example; a motor will sometimes start in reverse when it will not start in the forward direction.

Our "kick" circuit is designed to minimise this problem by applying full voltage to the track for a fraction of a

The final schematic diagram of the controller incorporates the "kick in the pants" starting circuit and improved braking facilities.

second; just enough to get the motor armature moving. The voltage then reverts to that selected by the control knob or the inertia circuit.

In practice the idea works extremely well. The loco starts with a slight jerk — the exact amount can be selected — then picks up speed slowly as dictated by the inertia circuit. The effect is not unrealistic, since the jerk is minimal and normally barely sufficient to take up the slack in the rolling stock couplings.

On the other hand, the starting reliability is very high. Even when a loco fails to start the first time, a second kick — easily applied — will often be effective. In extreme cases the situation can sometimes be salvaged by switching to reverse, applying a kick without follow-up power, then switching to forward and trying again. Even this complex procedure is preferable to jabbing the loco with one's finger.

A basic circuit is shown in Fig. 1. The first point to note is the filtering network provided by D1 and C1. A filtered supply proved essential for the control circuitry and, since it was not practical, or even desirable, to filter the supply to the rails, we simply filtered what we needed. The diode / capacitor combination is a particularly effective one.

Inertia is provided by C2, in the base circuit of TR1. The two 5.6k resistors (R1, R2) each side of it perform a number of functions. Collectively they serve as a current limiting resistor for the base of TR1. Separately, they control the rate of acceleration and deceleration. R1 controls the rate at which C2 can charge to the voltage set by the moving arm of the throttle pot (R3). R2 controls the rate at which C2 can discharge through the base circuit of TR1.

Their total value also has some bearing on the spread of the throttle movement. If the value is too low TR1 and TR2 may saturate before the throttle is fully advanced, making its operation critical. If too high, the power available to the track will be limited. The values chosen are a compromise between all these requirements.

While the amount of inertia could be varied by varying these resistors, this is not recommended in view of the factors just mentioned. The better approach would be to vary C2 although, in practice, the value we have chosen should suit most situations. In this regard it must be remembered that the final circuit has a brake function which can override the natural deceleration function.

This simple circuit is quite practical and, in fact, the reader may care to build it to this point as a first step. This approach is particularly recommended for those whose knowledge of electronics is minimal. However, the circuit has several limitations. The most serious is that when the throttle is advanced from zero the train hesitates for a time until the voltage increases to the minimum necessary to start it. To overcome this problem it was decided to prevent the inertia capacitor from discharging completely. This is accomplished by adding a 1k tab pot (R4), a diode (D2), and a 47 ohm resistor (R5). (Fig. 2).

The setting of R4 determines the minimum voltage across C2 and, therefore, the minimum speed of the train. Diode D2 isolates the two circuits so that the voltage determined by R4 is effective only when it is greater than the voltage determined by the throttle (R3). Once the voltage from R3 is greater, the diode is reverse biased and ceases to conduct. R5 is simply a limiting resistor.

In use, R4 can be set so that a train will just stop with the throttle fully retarded, but one setting may not suit all locos, or even the same loco when it is either hot or cold. In practice it is best set for a minimum speed, the brake circuit being used to bring it to a stop.

The only snag with this idea is that when the brake is released the train may start again before it is required to do so. To overcome this we modified the throttle (R3) to a switch pot, the switch being used to open-circuit the base connection of TR1 (Fig. 3). With this arrangement the throttle is first moved to the minimum position until the train slows to minimum speed, the brake applied to stop it, and the throttle then switched to the "off" position to

prevent it from starting prematurely.

This switch has another useful function. It will stop the train instantly and is very valuable in the event that a possible crash is likely to damage an expensive model. In these circumstances realism takes second place.

The braking system is shown in the final circuit (Fig 3). It consists of a 5k tab pot (R6) and a push-button switch between the base circuit of TR1 and chassis. When the switch is closed C2 is discharged through R6 and all voltage removed from the base of TR1, bringing the train to a halt. The circuit overrides the minimum speed circuit involving R4 etc. The rate at which C2 is discharged depends on the value of R6, which can be set by the builder for greatest realism.

Once again, we suggest that readers may care to build the unit to this stage, and test it, before proceeding further. In fact, we built our own unit to this stage and experimented with it for some time before evolving the next feature.

This is the "kick in the pants" circuit previously mentioned. The idea was born largely of frustration; the frustration of both ourselves and most other model train enthusiasts when a train refuses to start on cue.

Having been reminded of just how frustrating this can be while testing the new controller we began to wonder whether something could be done about it. At first we tried simply discharging the largest capacitor we could find directly across the rails. While impractical, it did prove that a kick of this kind would start a stalled loco almost as effectively as jabbing it with a finger — and a good deal more realistically.

A more practical approach was to discharge a much smaller capacitor into the base circuit of TR1 at the moment the throttle was advanced from zero. Again, a manually operated mock up proved the worth of the idea.

The problem was how to operate the kick circuit automatically from the throttle. While we had a spare set of contacts on the switch pot, and this seemed a logical place to start, the simple switching action it provided was not adequate. We needed a changeover combination so that the kick capacitor could be switched into a charging mode while the train was stationary, then switched to discharge through the base circuit when the pot switch was operated.

While we considered a number of schemes, including adding extra switch functions to an existing pot shaft, they all presented problems of one kind or another. Finally we took what was really the easy way out, and added a relay with the necessary switch functions. While it might be possible to devise a more elegant all-electronic system, we reasoned that relays were something with which most train enthusiasts were readily familiar and could probably supply from their junkbox. Even if they had to buy one, they would probably be happier with it than a complex circuit which they could not understand.

As it turned out, the decision provided a worthwhile bonus. With an extra set of contacts on the relay — normally provided anyway — it becomes relatively simple to use the control unit with a signalling system

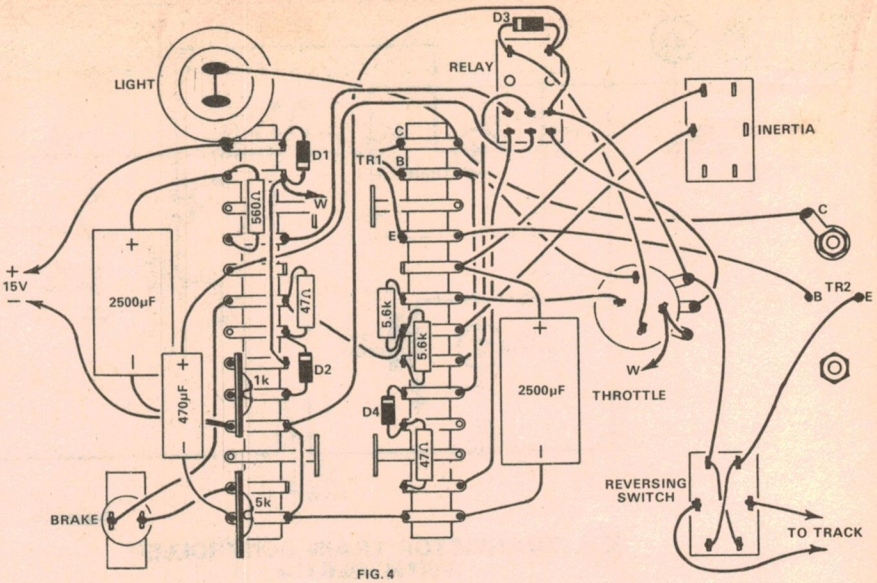


FIG. 4

Above is the complete wiring diagram for the controller. This should be used in conjunction with the accompanying photographs.

LIST OF COMPONENT PARTS

SEMICONDUCTORS
4 EM401 silicon diodes, or similar
1 TT801 NPN silicon transistor
1 2N3055 NPN silicon power transistor, with insulation mounting kit

SWITCHES
1 2 pole, double throw
1 single pole, to match
1 spring loaded single pole, normally open

CAPACITORS
1 470uF 25VW electrolytic
2 2500uF 25VW electrolytic

Resistors (¼W unless specified)
2 47 ohms
1 560 ohms
2 5.6k
1 1k preset pot, linear
1 1k potentiometer with switch (double pole), linear
1 5k preset pot, linear

MISCELLANEOUS
1 panel, see text
1 12V 40/50 watt double filament headlight lamp (see text)
1 12V miniature relay, with two changeover sets
1 knob
1 bezel, red
2 13 bit tag strips
Hookup wire, solder, screws, nuts, 18 gauge tinned copper wire, terminals if required, case if required (see text).

Note: resistor wattage ratings and capacitor voltage ratings are those used in our prototype. Components with higher ratings may generally be used provided they are physically compatible. Components with lower ratings may also be used in some cases, providing ratings are not exceeded.

while retaining the inertia effect. As shown in Fig 3 the extra set of contacts are connected in the moving arm circuit of R3. We will have more to say about using this facility in a future article.

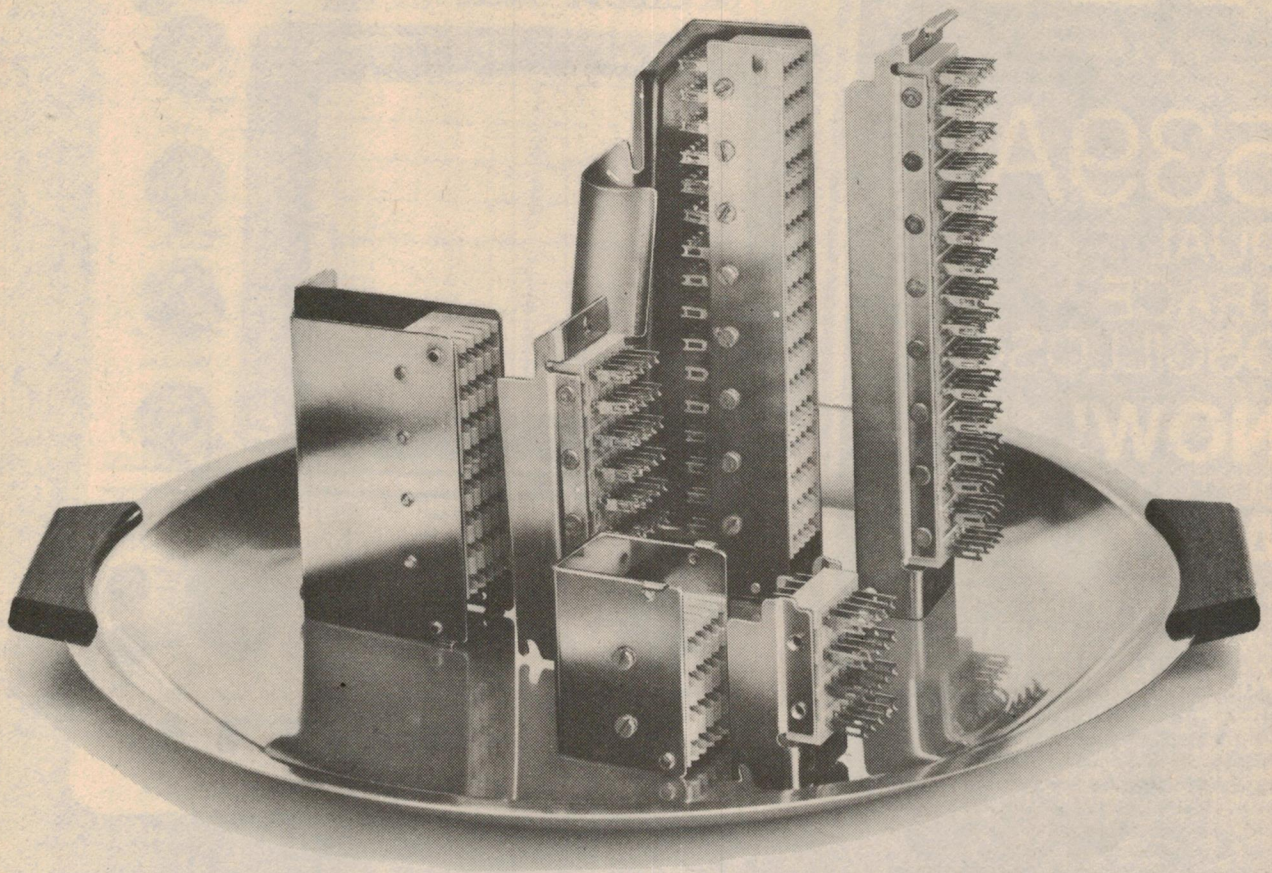
The kick circuit consists of a 470uF capacitor (C3), the relay changeover set, two current limiting resistors (R7, R8) and a diode (D4). When the throttle is set to the off position the relay coil is disconnected by the pot switch and the relay connects C3 to the filtered supply rail via R7. C3 charges in a fraction of a second and remains charged until the relay is activated by the throttle being advanced.

When this happens, C3 is connected directly to the base circuit of TR1 and, for a very brief period until it discharges, switches TR1 and TR2 into full conduction. As a result, full voltage is applied to the loco for long enough to start the motor moving, but not long enough to produce any significant high speed movement of the train. As C3 discharges, the minimum speed circuit takes over, followed by the inertia circuit.

Overload protection is by a filament lamp, functioning as a non-linear resistor in the collector circuit of the Darlington pair. During normal running conditions, the current in the lamp is a small fraction of its normal rated current, and the lamp resistance and the voltage across it are very low. This means that the voltage being applied to the loco is not measurably reduced.

During overload conditions, such as when the loco is derailed and short circuits the rails, the current through the transistor and the lamp increases. The resistance of the lamp increases by a factor of about eight, so the voltage across it increases to a value close to the normal rated voltage. This limits the voltage across the transistor to a safe value. The light output from the lamp can be used as a visible overload warning by placing it beneath a red bezel.

The wattage rating of the lamp depends on the power consumed by the train. It must be large enough so that under normal running conditions the filament does not heat to any noticeable extent — this can be checked by observing the filament, which should not glow at all. On the other hand, the wattage should not be so high that the maximum permissible ratings of TR2 are



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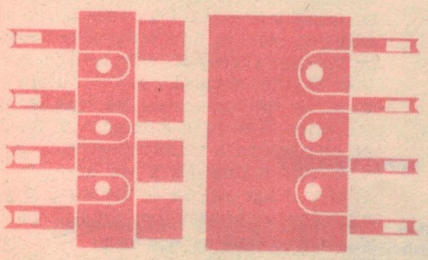

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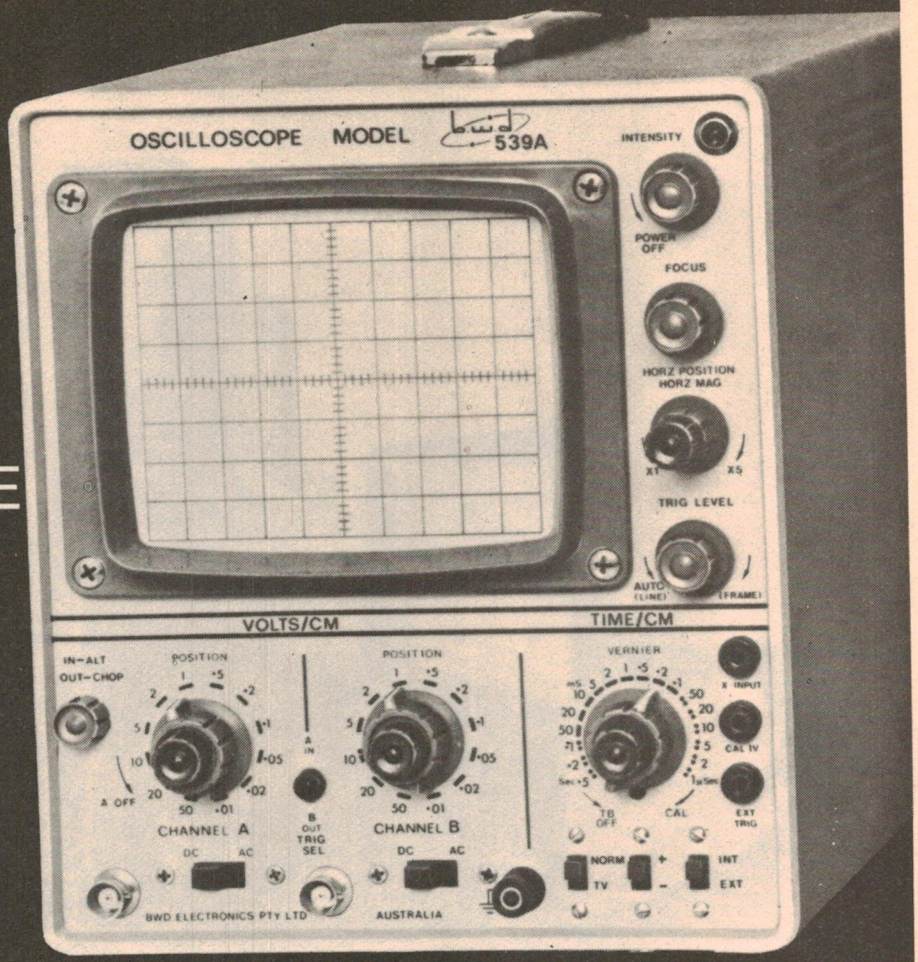

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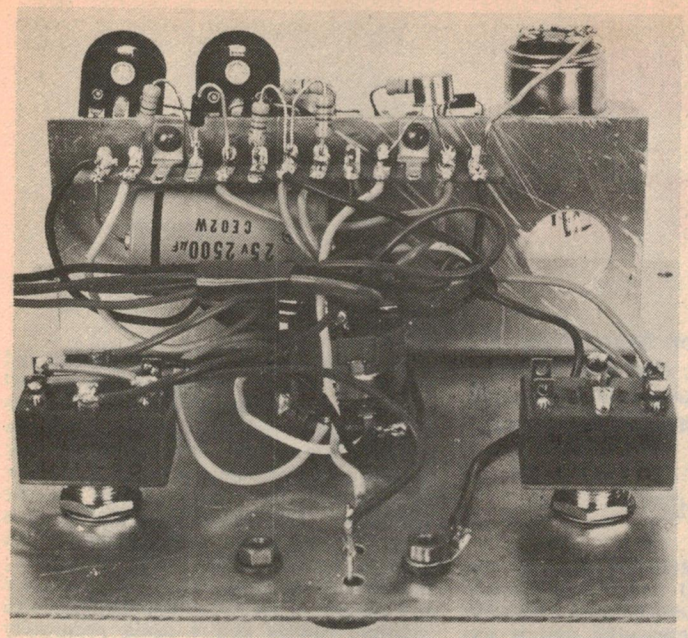
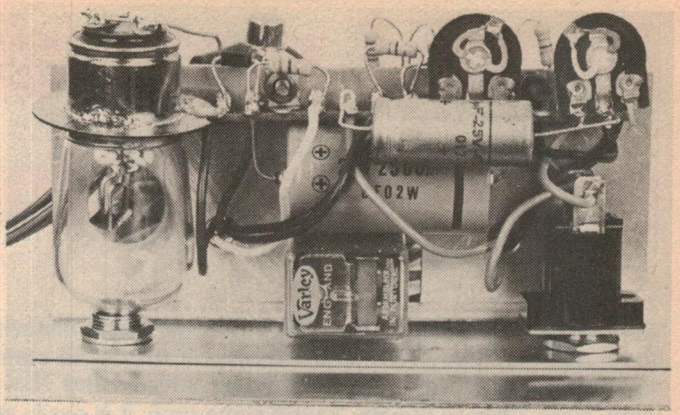




Above: the respective positions of the first tagstrip, the brake switch, the overload indicator, and the relay are clearly shown in this view of the top side of the mounting bracket.

At left, this view of the underside of the bracket and the bottom half of the front panel shows the mounting arrangements for TR2 (centre foreground), the inertia switch (at right), the direction switch (at left), the throttle control (centre), and the second tagstrip.

exceeded. In practice, with the largest lamp likely to be readily available, these ratings are not even approached.

We fitted a 12V 50 / 40W twin filament car headlight lamp, with both filaments in parallel. This should be large enough for almost all likely situations, yet provides adequate protection for TR2. The only real objection to this arrangement is the cost of the lamp (about $3), although it should be appreciated that, in this role, it should have an indefinite life.

A possible compromise is to use a discarded lamp in which one filament has been burnt out. This may restrict performance slightly for larger locos, or when double heading, but not seriously. The next compromise is a 21 / 6W stop tail light, with both filaments used to make a 27W lamp. This would be suitable for use only with small locos but, if two such lamps are used in parallel, making a 54W unit, performance will be at least as good as from a single filament headlight lamp. Since these lamps cost only about 45c each they are a much better proposition financially.

In constructing the unit, we elected to fit all the components onto a single front panel. The idea was that the panel could be fitted easily into an existing control layout, or it could be used as the lid or top panel of an available box. We used the latter idea, and dimensioned the panel to suit a standard sloping panel instrument case (approx 6in x 6in x 6in) such as we used for our previous controllers. The panel layout is shown in the photograph.

This is a suggested layout only, and constructors may wish to vary it. We found that as the design evolved, there was not enough space to mount all the components, so a right-angle bracket was used. This was attached to the panel by the overload bezel and the brake switch, thereby avoiding unsightly screws on the front panel. To this panel was fixed the relay and the two tag strips.

The wiring and layout of components on the tag strips is not critical. Our layout is shown in Fig 4. The preset pots should be positioned so that they are readily accessible for adjustments. We found it an advantage to use coloured wires, as this makes the wiring easier to trace when it is being checked.

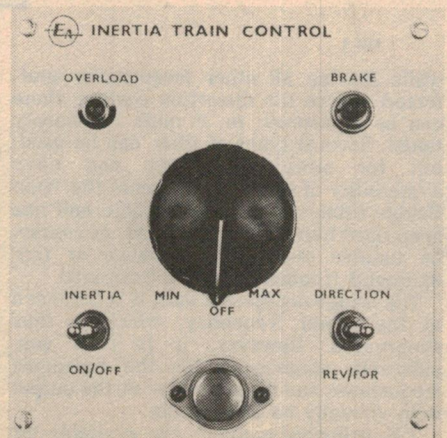
We mounted the light bulb using heavy gauge tinned copper wire, which provides both electrical connection and mechanical support.

When the unit is completed and checked, it can be connected to a suitable supply, being careful to ensure the right polarity. The output can then be connected to a track, preferably a circular one as continuous running facilitates testing, and a train placed on the rails. The inertia is switched off, and R3 set to the minimum speed position. (Not the off position.)

The minimum speed is then set by the preset pot, R4. It is set so that the train will run steadily at a slow speed, but so that when the train is stopped, say by momentarily touching it with a finger, it will remain stopped.

The "kick in the pants" effect can now be tried, by switching R3 from minimum to off and back again. The train should stop when switched to off, and start with a small jerk when switched to minimum speed. If this jerk is too violent, C3 can be reduced in value. If the train does not start reliably, the value can be increased.

It should now be possible to vary the speed of the train smoothly from minimum to maximum by R3. When the train is at full speed, the track can be shorted out. The train should stop, and the overload indication should glow. When the short is removed, the train should move again.



The front panel layout can be easily duplicated from the above photograph.

With the train stationary, and the speed control in the off position, the inertia can be switched in. Allow a few seconds for the inertia capacitor to charge to the voltage set by the minimum speed pot, and then advance the speed control to the full speed position. The train should start immediately with a small jerk (due to the "kick in the pants"), and then accelerate slowly to maximum speed, which should be reached in about 15 seconds. When the speed is reduced to the minimum setting, the train should slow to its minimum speed in about the same time. It should not stop.

With the train running at minimum speed, depress the brake. This should stop the train in a short distance. This distance is set by R6 and can be varied to suit individual requirements.

Alternatively, the brake can be adjusted with reference to the distance required to stop from full speed. With the train going at full speed, and the inertia switched in, set the speed control to minimum, and apply the brake. The train should stop in a distance that is realistic in comparison to the distance taken to coast from maximum to minimum speed.

The power supply required to run the train and controller should be capable of supplying a nominal 12V DC, with a current rating of from 2 to 5 amps. Best performance will be obtained if the supply is not smoothed. We used the "Train Power Supply," as described in the April 1968 issue, set on the 15V tap. The normal commercial "train transformer / rectifier" should be quite suitable, since the majority of these units consist of a 15V transformer and associated rectifier.

It should be remembered that best performance will only be obtained from the controller if the rails are kept clean and free from dirt, to minimise contact resistance. Rail joint resistance is also a cause of poor performance. This can be minimised by connecting the power to the rails at several points, normally spaced about 1 metre apart.

A solid state audio distortion factor meter

The first of two articles describing a reliable audio distortion factor meter for home construction. The meter circuitry is fully solid state, and will measure down to 0.1pc DF on signals between 200mV and 75V over the frequency range from 20Hz to 20kHz. At the same time, it is easily set up and calibrated using simple equipment.

by F. G. CANNING, FIREE (Aust)*

For anyone seriously concerned with experiment, design or servicing on high-quality audio equipment, a reliable method of measuring the distortion it introduces into a pure signal is almost indispensable. Such measurements are not especially difficult although rather time-consuming. The necessary instruments are fairly complex and, in their commercial form, quite expensive. For those who do not have the research-and-development budget of a sizable company to draw upon, this cost factor can be a problem.

The design to be described here was worked out with this factor well in mind. It should enable the experienced constructor to build for himself a reliable and flexible Distortion Factor Meter at a fraction of the cost of a commercial instrument. There is nothing very difficult about its construction or the components used, but it must be said that careful workmanship and accurate components are essential and the project cannot be recommended to an inexperienced constructor. Practical points to be watched will be highlighted as the description proceeds and if these are observed no difficulties need be feared.

The term distortion factor now commonly quoted for high-fidelity amplifiers defines the additions made by the imperfect equipment to a single pure sine-wave input signal. These additions include hum and noise as well as harmonic distortion, and their combined RMS voltage is expressed as a percentage of the total output voltage at the fundamental signal frequency; this percentage is the Distortion Factor which is to be measured. Note carefully that this is a voltage ratio, not a power ratio which would give a much more flattering figure.

What we have to do, then, is firstly to measure the total output voltage of the amplifier under test at the output level and frequency which interests us. This output will consist of three components: the amplified signal at the fundamental (input) frequency, the sum of the harmonics generated in the amplifier, and any hum and noise introduced by the amplifier. These can be called, respectively, V (for the fundamental), D (for harmonic distortion) and N (for noise and hum). This combined output voltage is noted.

Next, we must eliminate the fundamental voltage V, by a suitable filter and then measure the combined voltage of the remaining factors D and N. This much smaller voltage is then compared with the voltage previously measured and is expressed as a percentage of it; this is the Distortion Factor. In the instrument to be described this comparison is done by a calibrated potential divider and the Distortion Factor is read directly from its scale.

From the foregoing, it is clear that the filter referred to, commonly called a "Notch Filter," must be capable of eliminating the fundamental frequency while leaving all other frequencies unaffected, before the distortion content alone can be measured; ie, it must be sharply tuned. Several types of filter can be used but for simple handling and easy availability of cheap components the Wien Bridge filter seems most suitable and has been used here. The filter must, of course, be tunable over the full range of fundamental frequencies to be examined.

The bridge is adjusted until it is balanced at the signal frequency, which is thus suppressed. However, it is then considerably unbalanced for the harmonic frequencies and these appear at the output with virtually no attenuation.

Two principal methods are available for measuring Distortion Factor and they are shown in Fig 1, A and B. Each has some advantages and certain drawbacks.

In 1A, the signal to be investigated is fed through a variable attenuator to a ganged "function switch" S1 and S2 which connects the attenuator output either directly to a multi-range AC voltmeter (for measurement of signal plus distortion) or else through the "notch filter" to the voltmeter (for measurement of distortion only). The attenuator setting must remain unchanged for both measurements; therefore the voltmeter has to be a sensitive instrument (actually a millivoltmeter) with multiple ranges and a scale accurately calibrated over all its ranges. It must also have a frequency response which is flat over the full range of fundamentals plus their harmonics, up to at least the fifth — in practice, from 20Hz to around 100kHz. Such a voltmeter is an expensive thing to buy and almost beyond the scope of an experimenter to construct and calibrate; therefore this scheme was thought unsuitable for the present project.

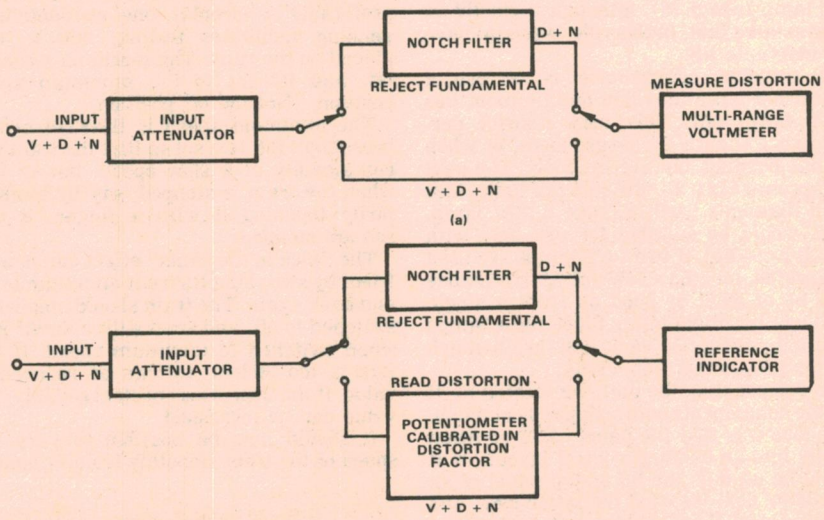


FIG. 1

The second method, Fig 1B, requires only a single-range AC millivoltmeter which does not have to be calibrated, as it is used only to give a single reference voltage reading. However, it still must be sensitive and have the necessary flat frequency response covering all of the harmonic range. If it can also give a true RMS indication rather than an average one this is an advantage, though not essential.

As before, the distorted signal is fed through a variable attenuator to the "function switch." However, from this point it goes to the voltmeter either through the "notch filter," which thus shows distortion and noise only, or else through a calibrated potential divider which passes both fundamental and distortion. In this method, distortion is first read by switching in the filter, balancing it to suppress the fun-

*30 Back Beach Rd, Portsea, Vic 3944.

damental, and finally adjusting the input attenuator until the remaining distortion voltage produces a certain reference reading on the meter, indicated by a mark on the scale. The filter is then switched out and replaced by the calibrated potentiometer which passes both fundamental and distortion; this potentiometer is then set to produce the same reference reading on the meter. At this point the potentiometer output voltage has the same value as that of the distortion and noise in the signal, so that the potentiometer can be calibrated directly in percentage Distortion Factor.

This method has the advantage that the meter scale needs no calibration beyond the provision of the reference mark, and the meter accuracy is therefore unimportant. The accuracy of the calibrated potentiometer is merely a matter of using close-tolerance resistors, plus the making of a linear scale to suit a normal wire-wound potentiometer, and this is easily within the home constructor's ability. The method also has the advantage that since the meter is always used at high sensitivity, the notch filter and its amplifier are always working

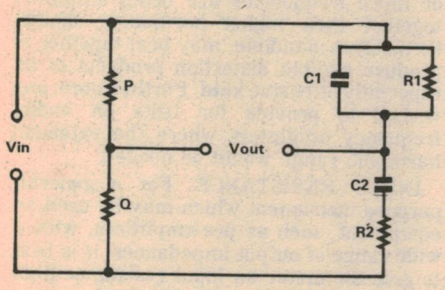


FIG. 2

at a very low signal level and are therefore less likely to introduce distortions of their own. (It must be realised that in any scheme of this kind the meter cannot distinguish between distortion in the input signal and distortion produced in circuits before the Wien Bridge, so the latter must be made negligible).

The drawback to this second scheme is that the very low signal level and high meter sensitivity required makes the whole circuit more liable to induced and self-generated noise — eg transistor noise. However, careful choice of components and adequate shielding have overcome this difficulty. The reason for the high meter sensitivity will appear when we come to the details of the performance specification.

We have seen that when the fundamental frequency has been suppressed the output of the equipment under test is a mixture of distortion and noise. If we now switch off the source of the test signal at the input to the equipment, leaving everything otherwise unchanged, the remaining noise showing on the meter is the noise generated by the equipment under test. This noise, in the case of a mains-operated device, will probably have two components:

(a) mains hum, chiefly at twice the frequency of the mains, or 100Hz in this country, but quite possibly at harmonic frequencies also. In some localities the mains supply has been found to have a strong fifth harmonic which is not easily eliminated.

(b) so-called "white noise" or hiss, whose strength will depend somewhat on the bandwidth passed by the equipment — in general, the wider the bandwidth the greater the measured noise. However, the noise actually audible will not necessarily increase to the same extent, because the response of the human ear peaks at around 5kHz and decreases so rapidly above 10kHz that increased noise above this frequency goes largely unnoticed by most people. To take account of this, professional distortion and noise meters often include a "Weighting Filter" which can be switched in to give a weighted noise measurement corresponding to one of two international standards representing broadcast and line telephony conditions respectively. This added complication was not thought worthwhile for the present simplified design.

Another form of noise which may appear under these conditions is parasitic oscillation, either continuous or intermittent, the continuous type often being masked by the test signal but showing up when it is switched off. The distortion factor meter can be very useful in tracing and curing such troubles.

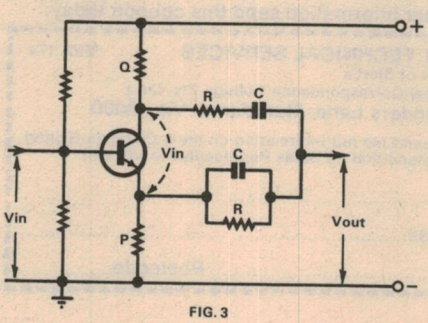


FIG. 3

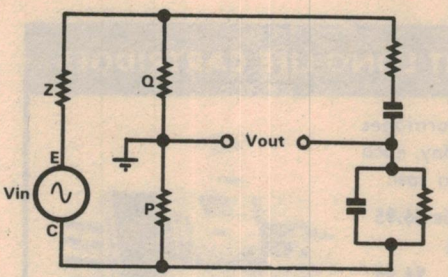


FIG. 4

Let us now consider the performance specification for a practical meter:

SENSITIVITY. We first consider what signal voltages we are likely to meet. At the low end the most likely item to need testing will be an audio-frequency preamplifier and the lowest output voltage commonly met here will be around 200 millivolts. This, then, can be our lower design limit, though in practice this instrument can be used down to around 150 millivolts. We next decide on the lowest distortion percentage we expect to measure accurately, and in the present design 0.1pc was chosen. Now 0.1pc of 200 millivolts is 200 microvolts and this input must give the standard meter deflection, chosen in this case to be 70pc of full scale reading. This, then, becomes the sensitivity required of our meter and it will be working at this sensitivity at all times. To combine this performance with a bandwidth extending to 100kHz and using a small inexpensive meter movement presented some problems, now overcome, especially from transistor noise.

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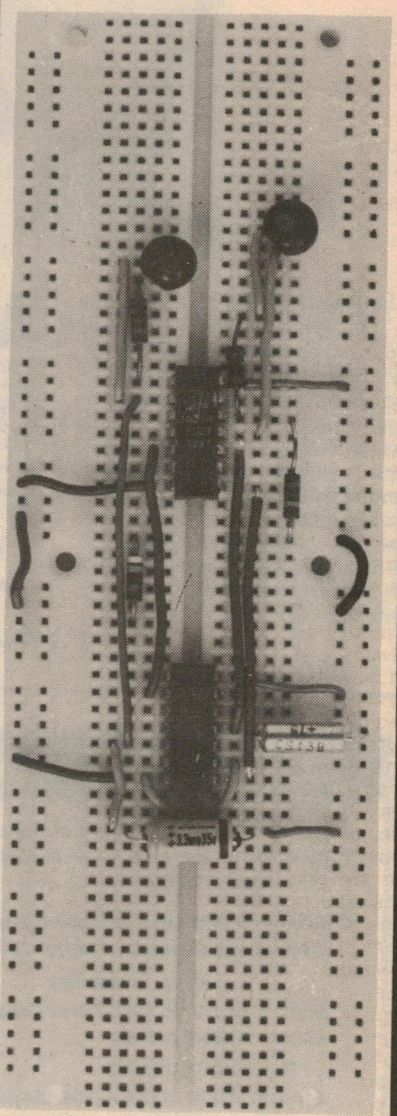

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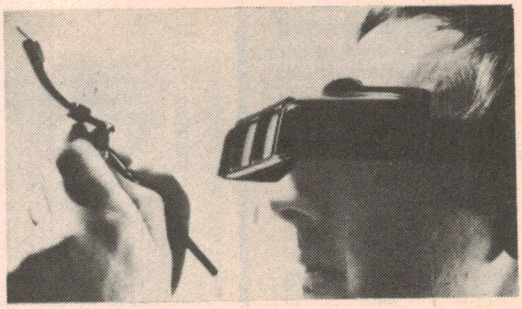

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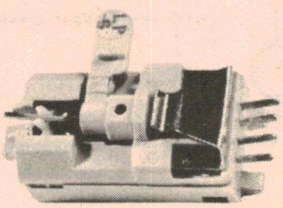

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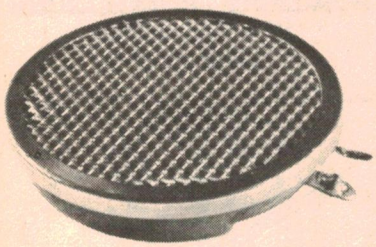

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amplifiers with an output of at least 100 watts may have to be tested, so the range of the input attenuator will have to be considerable. The present design will handle inputs up to 75 volts, equivalent to an amplifier output of 700 watts into 8 ohms, which should take care of any likely situation.

FREQUENCY RANGE. This was chosen at 20Hz to 20kHz, covering the whole useful range normally claimed for audio equipment. It is covered in three switched overlapping ranges.

DISTORTION RANGE. The basic range is from 0 to 0.5pc with switched multipliers giving X10 and X100 times.

HARMONIC RANGE. It was decided to include harmonics up to the fifth in all measurements; thus the meter circuit must have a flat response to 100kHz (fifth harmonic of 20kHz). The need for this might be questioned since even the second harmonic of 20kHz is quite inaudible. However, there is some evidence suggesting that when two or more frequencies are being amplified together their higher harmonics, though themselves inaudible, may beat together to produce audible distortion products of an especially offensive kind. Furthermore, one wished to provide for tests on audio-frequency oscillators where the extended harmonic range would be needed.

INPUT RESISTANCE. For a general-purpose instrument which may be used on equipment, such as pre-amplifiers, with a wide range of output impedances, it is best to give the meter an input resistance high enough to impose negligible load on any likely signal source. A value of 250k was chosen, being about the highest figure that can be used without difficulties due to high value non-standard resistors in the attenuator and, possibly, excessive residual noise.

The complete circuit diagram of the final instrument is shown as Fig 6. The instrument comprises four distinct and separate sections and these are now described in detail.

The Input Circuit. Four pi-section pads connected in series, together with a continuously-variable potentiometer comprise the input attenuator. Each pad gives 12dB loss, with an image impedance of 500k. As the attenuator is image-matched the input impedance is 250k for all positions of the switch S1, which provides the coarse control. The 500k carbon potentiometer RV1 provides the fine continuous control.

It is evident that when the circuit is switched from "Reject Fundamental" to "Read Distortion" the load on the input attenuator will vary considerably unless it is isolated. For this purpose a buffer stage (Tr1) is provided. This stage is critical, in that any noise generated there will appear in the measured distortion. After tests of several types of bipolar transistors, the Texas Instruments type 2N5245 field-effect transistor was found to give good results as a source follower in this circuit. The collector circuit is heavily decoupled for stability.

The Notch Filter (Wien Bridge). Fig 2 shows the elements of a Wien Bridge in

The complete circuit of the distortion factor meter is shown opposite. It uses only nine transistors.

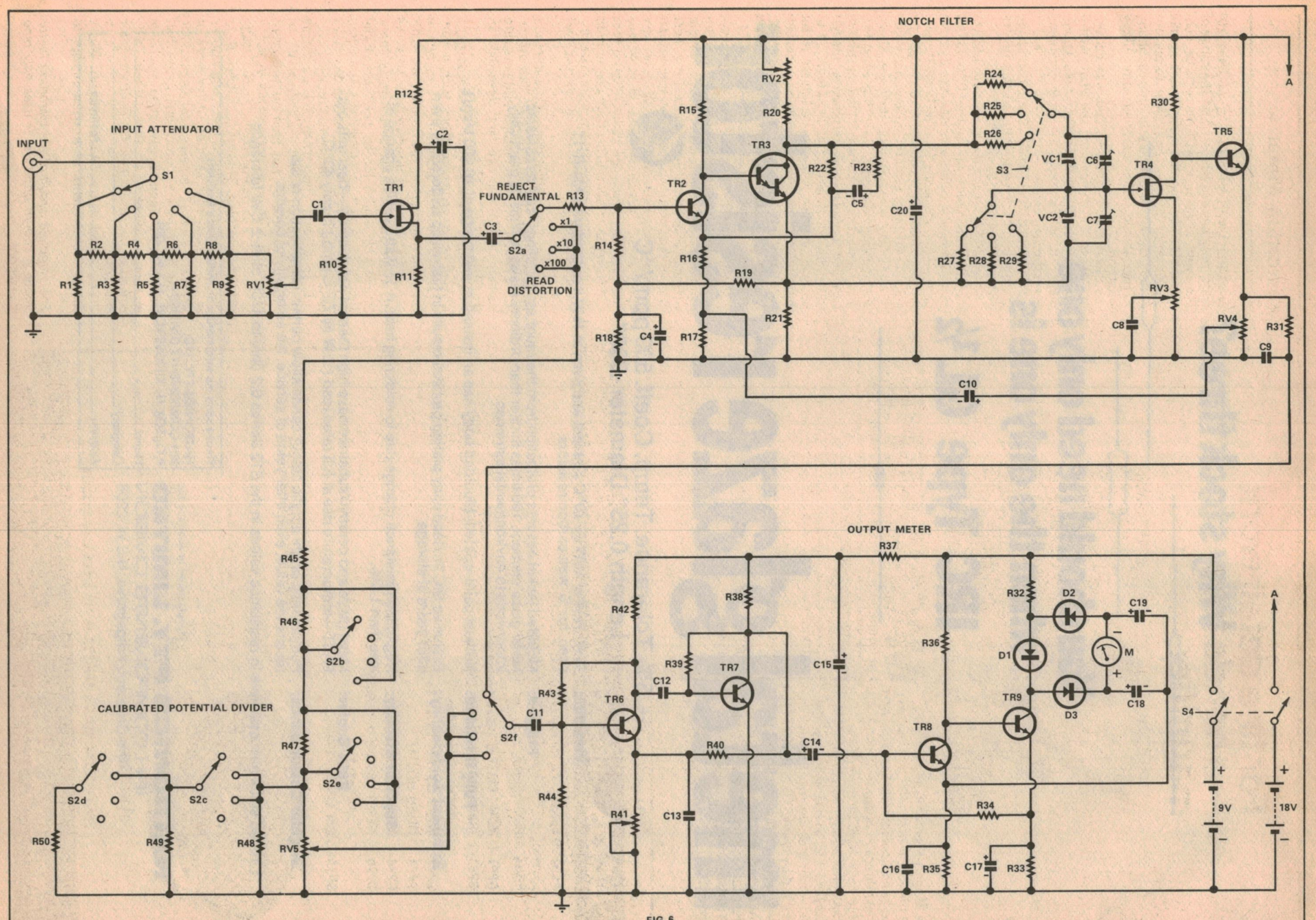
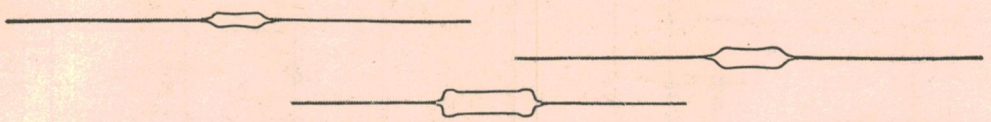

NOTCH FILTER
INPUT ATTENUATOR
INPUT
S1
R1
R2
R3
R4
R5
R6
R7
R8
R9
RV1
C1
R10
TR1
R11
R12
C2
C3
REJECT FUNDAMENTAL
R13
S2a
x1
x10
x100
READ DISTORTION
R14
TR2
R15
R16
R17
R18
C4
R19
TR3
RV2
R20
R21
R22
R23
C5
C20
R24
R25
R26
S3
VC1
C6
VC2
C7
R27
R28
R29
TR4
R30
TR5
RV3
C8
RV4
R31
C9
C10
A
OUTPUT METER
R37
R38
R42
R39
TR7
C12
R43
TR6
C11
S2f
C15
R36
R32
D2
C19
D1
M
TR9
D3
C18
TR8
R40
C14
R44
R41
C13
R34
C16
R35
C17
R33
S4
9V
18V
CALIBRATED POTENTIAL DIVIDER
R45
R46
S2b
R47
S2e
S2d
S2c
R50
R49
R48
RV5

FIG. 6

Why stock three?



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basic form. If C1 and C2 are made equal, (denoted by "C") and R1 and R2 also equal (denoted by "R"), the conditions for balance (in this application, maximum fundamental suppression) are:—

$$(a)\ \frac{P}{Q} = \frac{1}{2}$$

$$(b)\ 2\pi FCR = 1$$

Thus the bridge will balance at frequency $2\pi F$ when

$$Q = 2P$$

$$2\pi F = \frac{1}{CR}$$

(C in farads, R in ohms, or C in microfarads, R in megohms.).

A bipolar transistor amplifier can be added to give the practical circuit in Fig 3 and its equivalent circuit in Fig 4. This arrangement gives input and output connections balanced with respect to ground and assists a sharp null.

For a true measurement of DF it is necessary that only the fundamental frequency is suppressed, and that all the harmonics from the second upwards shall reach the output of the notch filter unchanged. This implies quite sharp tuning. The frequency characteristic of the basic Wien Bridge is shown in Fig 5 and it is plain that the response to the harmonics is far from equal, there being a substantial difference in response between, say, the second and fifth harmonics; in fact, the second harmonic is nearly 5dB down. This, if not corrected, would give an apparent DF substantially better than the true figure.

This is remedied by including the bridge circuit within the loop of a negative-feedback amplifier. By this means the overall response to harmonics can be made level to within 1dB, and with an insertion loss for all harmonics of less than 1dB. (See Fig 6 for circuit).

There are two important factors to be watched in the design of the feedback amplifier, apart from its possible introduction of noise and distortion of its own making. Firstly, the amount of feedback must be sufficient to achieve the desired flat harmonic response, but no more; excessive feedback sharpens the tuning to an uncomfortable degree, making the instrument difficult to handle and increasing the chances of instability and distortion of the fundamental, due to the large signal offered to the transistors at the null point where the feedback loop is effectively broken. The feedback required is X10 or a little more (20 to 21.5dB).

Secondly, the gain of the complete notch filter circuit with its feedback applied (ie the closed-loop gain) must be closely unity, otherwise the harmonic voltage offered to the meter in the "Reject Fundamental" position will not be comparable to that coming from the calibrated potentiometer in the "Read Distortion" position, the potential divider having no associated amplifier.

These two factors, therefore, require that the overall open-loop gain (with feedback temporarily removed) shall be X10, and that this gain shall then be reduced to unity by adding closely-controlled negative feedback, which will then be effective for all frequencies except the fundamental. These points seldom seem to be clearly brought out in such published discussions as the writer has seen.

The Wien Bridge can take either of two forms, namely, with fixed capacitors and ganged variable resistors for tuning, or with fixed resistors and ganged variable capacitor tuning. The first method offers the advantage of relatively low-resistance circuits which minimise noise and hum troubles and this method was originally used here, with a pair of ganged 10k wirewound potentiometers for tuning in conjunction with pairs of precision fixed capacitors. However, prolonged experiment failed entirely to make this arrangement workable. Both tracking and resolution of these ganged pots proved inadequate for the precise setting needed for a true null and it proved impossible to get reliable and repeatable settings; handling was also intolerably critical. The method was finally abandoned and the alternative adopted, using a two-gang variable capacitor taken from a broadcast receiver and fitted with a reduction drive, and this solved the problem. It does, however, require good metallic shielding both between sections of the instrument and also overall by means of the cabinet, otherwise noise pickup from the mains or adjacent apparatus can be troublesome. It also requires non-standard fixed resistors of high ohmic value and very close tolerance, but these can be assembled from standard preferred values connected in series, as follows:—

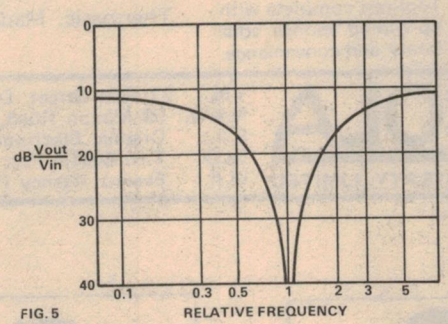

FIG. 5

For 16.8 megohms, use 10 megohms and 6.8 megohms in series.

For 1.68 megohms, use 1 megohm and 680kΩ in series.

For 168kΩ use 150kΩ and 18kΩ in series.

These values do not have to be exactly correct; the vital thing is that they shall be matched in similar pairs to within 1 per cent, one for each side of the bridge. A good Wheatstone bridge will do the matching, the lower of each pair being brought to within tolerance of its companion by the addition of a further series resistor of suitable lower value. Failing a bridge, if a DC supply of at least 250 volts — say from a valve broadcast receiver — is available together with a good 50 microamp meter having a knife-edge pointer, the resistors can be matched individually by the arrangement shown in Fig 7 overleaf.

Starting from zero volts, increase the potentiometer setting gradually until some arbitrary scale division is reached, as near to full-scale as possible, and use this point as a reference mark for the selection of another resistor giving the same reading. With care a 1pc difference can be seen clearly, but the work must be done at a time when the mains voltage is steady (perhaps late evening). The potentiometer must be a linear wire-wound type of good quality and it may be advisable to alter the shape of the rotating contact to get as near to a single-turn resolution as possible. Failing these methods the resistors will have to be ordered as high-stability types of ±1pc tolerance, but closer tolerances do make a perfect null easier to obtain.

The emitter and collector resistors of the bridge amplifier Tr3 (1k and 1.9k respectively) must also be within 1pc tolerance. Theoretically the collector resistor should be 2k exactly, but in practice other tolerances in the range resistors and ganged capacitor make it necessary to provide a very finely-adjustable control over the exact value of this resistor. This is done by the 500ohm variable resistor RV2 in series, is a 10-turn helical potentiometer mounted on the front panel and used as the fine control in the "Reject Fundamental" procedure. Note especially that a normal single-turn potentiometer is useless in this position as it cannot be set accurately enough. An accurate 1.9k resistor can generally be selected from a collection of 1.8k 10pc tolerance samples.

The circuit of the notch filter as shown in Fig 6 is a modified and simplified version of one described by J. Linsley Hood (Wireless World, July 1972). Tr2 is a preamplifier feeding Tr3 and the bridge network. It is selected especially for its low-noise performance and for the same reason is operated at very low collector current of 10 to 15 microamps. Many low-noise and high-gain types were tested here but it was not found possible to improve on the 2N930 finally specified. In addition to its good performance and modest price, this type seems inherently more stable, when used at very

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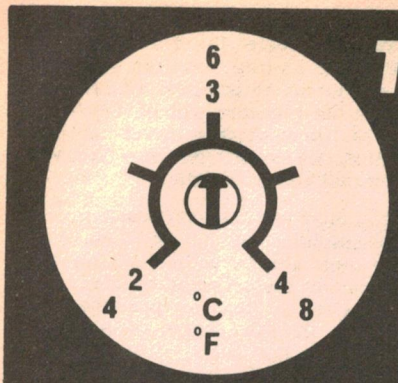

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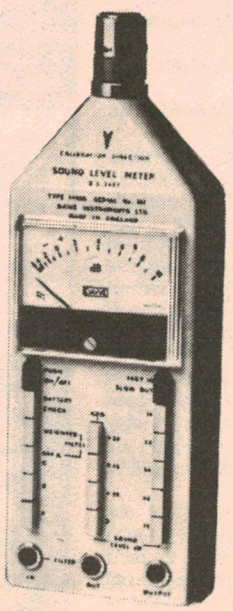

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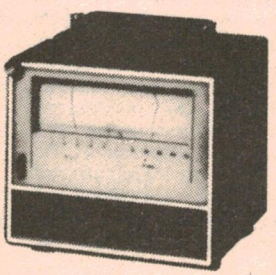

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small collector currents, than some later types which show marked drift with time, regardless of temperature.

Tr3 is a Darlington type made by Motorola and chosen for its very low noise factor of 2dB at 1kHz with high gain. It's characteristics enable a close approach to the theoretically ideal working conditions for the Wien bridge. This transistor is not generally stocked in Australia, but can be had from England within a fortnight by Air Mail from any Motorola distributor there, at the cost of an International Money Order for 24 pence sterling plus 65 pence postage and packing; one such source being A. Marshall & Sons, 28 Cricklewood Broadway, London N.W.2. Substitution of other types is not recommended.

DC and AC negative feedback is applied from Tr3 collector to Tr2 emitter, and DC feedback from Tr3 emitter to Tr2 base to stabilise the working point. The combination gives very low noise and distortion.

Since the base of Tr4 has no return to earth other than the bridge range resistors (16.8 megohms on the low range) and the signal path through the bridge is of high impedance, bipolar transistors which have comparatively low input impedance are hardly suitable for Tr4. A field-effect transistor, which draws virtually no gate current and needs no gate bias resistors, is a much better proposition and the Texas Instruments type 2N5245 was found satisfactory. The source resistor which furnishes gate bias in this circuit consists of a small "trim-pot" RV3 of 100k with a bypass capacitor of 0.1uF connected to its slider. This trim-pot is mounted in an accessible position for screwdriver adjustment and it controls the open-loop gain of the whole amplifier, gain increasing as the slider approaches the source terminal of Tr4.

Tr5, another 2N930, is an emitter-follower serving the dual purpose of a buffer between the notch filter and meter sections,

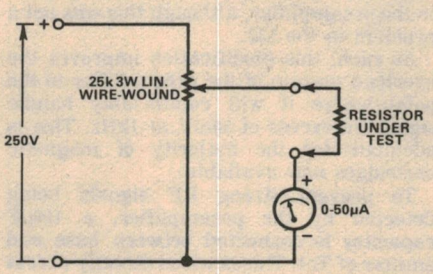

FIG. 7

and also as a means of setting the overall negative feedback of the system and thus adjusting the gain to unity, as previously outlined. The emitter resistor is RV4, another accessible trim-pot of 4.7k whose slider is returned through a 47uF tantalum capacitor to the emitter circuit of Tr2. With the slider at the earthy end, the feedback is zero and the open-loop gain can then be set to the required 10-12 times by adjustment of RV3, after which the slider of RV4 is advanced towards the emitter until the gain falls to unity. These adjustments are permanent. A suppressor resistor of 820 ohms (R31) takes the output of the filter to the meter section and serves, together with a 560pF capacitor, to suppress any tendency to high-frequency instability.

The filter and the attenuator buffer stage share a common 18 volt battery supply. This battery cannot, however, be used for the meter section also without instability, therefore the meter section has its own 9 volt battery.

The ganged capacitor in the bridge circuit is of 400 to 450pF per section; the exact value is not critical but the frequency coverage will vary accordingly. It should be of the best mechanical construction and electrical matching available. The writer used one of Philips origin with one-piece extruded frame and soldered brass vanes, taken from a broadcast receiver of the 1950's — a very accurate job. If no trimmer capacitors are provided suitable ones of 25 to 30 pF must be added. An AWA type 37582 gang is about the smallest capacity that can be used without altering the range resistors of the bridge. The Philips concentric air trimmer is effective and has the necessary long-term stability. The trimmers are used to give the final close adjustment of the bridge null at the highest frequency (gang capacitor near minimum) after RV2 has been adjusted as closely as possible, and thereafter are not touched. RV2 is used over the rest of the range and is most effective at the lower frequencies.

The gang capacitor requires an insulated low-capacitance mounting of very rigid construction to allow exact setting, and as its frame is connected directly to the gate of Tr4 it is prone to pick-up of hum, noise and feedback and needs some shielding, but need not be completely enclosed. For the same reason it needs to be set back from the metal front panel far enough to keep its spindle entirely inside the case, coupling to the external control being through an insulating universal coupling and a short length of ¼in insulating rod. I used a coupling supplied by Ham Radio, of 323 Elizabeth St, Melbourne. A slow-motion dial or control with a reduction of at least 5 to 1 — more for preference — is essential and it should be chosen carefully for absence of backlash. The writer used a RAPAR type VD2, of Japanese origin, but some work was needed to remove free play from its spindle.

(To be continued)

DISTORTION METER PARTS LIST

S1 1-pole 5-way switch.
S2 6-pole 4-way switch
S3 2-pole 3-way switch
S4 Double-pole On-Off switch.
M DC Microammeter, 0-100 microamps.
1 Slow-motion dial, 5 to 1 reduction or greater.
1 9V battery, No. 216 or larger.
1 18V battery, 2X No. 216 or larger.
Shielded case, knobs, phono socket and plug, bolts and nuts, etc.
SEMICONDUCTORS.
Tr1 2N5245 (Texas Instruments)
Tr2 2N930
Tr3 MPSA14 (Motorola, see text.)
Tr4 2N5245
Tr5 2N930
Tr6, 7, 8, 9, BC109C
D1 1S44 (Texas Instruments)
D2, D3, 1N914

RESISTORS
R1 320k 1pc
R2, 4, 6, 8, 932k 1pc
R3, 5, 7 418k 1pc
R9 835k 1pc
R10 270k
R11 8.2k
R12 2.7k
R13 24k
R14 47k
R15 470k
R16 3.3k
R17 100ohms
R18 15k
R19 22k
R20 1.9k 1pc
R21 1k 1pc
R22 120k
R23 39k
R24, 27 16.8 M 1pc
R25, 28 1.68 M 1pc
R26, 29 168k 1pc
R30 47k
R31 820 ohms
R32 8.2k
R33 1.5k
R34 12k
R35 39 ohms
R36 22k
R37 1k
R38 22k
R39 1.5M
R40 10k
R41 220 ohms (see text).
R42 47k
R43 2.2M
R44 470k
R45 12k 1pc
R46 10.8k 1pc
R47 1.08k 1pc
R48 22k approx. (see text).
R49 1.33k 1pc
R50 133 ohms 1pc
RV1 500k linear Pot.
RV2 500 ohm 10-turn helical Pot. (Beckman "HELIPOT" type 7266, Warburton Franki.)
RV3 100k Trimpot.
RV4 4.7k Trimpot.
RV5 25k linear wire-wound Pot.

CAPACITORS
C1 0.22 uF
C2 220 uF, 20V Wkg.
C3 4.7 Uf 16V Wkg, tantalum.
C4 220 uF 10V Wkg.
C5 22 Uf 20V Wkg.
C6, 7 3/30 pF trimmer
C8 0.1 uF
C9 560 pF
C10 47 uF 16V Wkg. tantalum.
C11 4 uF Bi-polar electrolytic.
C12 1 uF polyester.
C13 2000 pF
C14 22uF 16V Wkg. tantalum.
C15, 17, 250 uF 10V Wkg.
C16 0.01 uF ceramic.
C18, 19, 22 uF 10V Wkg. tantalum.
VC1, VC2, 10/400 pF ganged air variable, or nearest.
C20 220 uF 20V Wkg.

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Playmaster 132 reconsidered

Featured in June, July and August 1971, the Playmaster 132 is the most powerful stereo amplifier we have published to date. In this article, we represent the circuit along with modifications to improve the performance, while also indicating additional transistor substitutions.

by LEO SIMPSON

The Playmaster 132 stereo amplifier has been very popular with constructors because of features like its "low profile" styling, slider controls and push-button source and mode selection. In these days of inefficient loudspeaker systems it has plenty of power, with a rating 45 watts RMS per channel continuous into 8 ohm loads. As a bonus, it incorporates a tuner of modest performance.

As is usual with any circuit or design, it is always possible to make worthwhile changes after it has been "finalised" or "frozen." Virtually all manufacturers make running changes to their products when it is possible to do so without changing the basic design. So too with the Playmaster 132 amplifier circuit. Experience has shown that worthwhile changes can be made in the circuitry without changing the copper pattern of any of the printed wiring boards. Depending on the particular amplifier and the circumstances in which it is used, these changes can make a substantial improvement to the system as a whole.

In this article we are re-publishing the complete circuit along with all the proposed modifications. In addition, we have specified new transistor types which take into account what is now readily available from kit suppliers.

The first place where worthwhile improvements can be made is in the preamplifier circuit which initially handles the signals from the magnetic cartridge. A common problem (with this amplifier circuit and others) is overload of the preamplifier. This can happen on loud recorded passages and, when it does the user just has to grin and bear it because he has no control over it other than to substitute a cartridge with a lower output.

In any preamplifier, a compromise must be selected between adequate gain, signal-to-noise ratio and overload margin. In the Playmaster 132 we have found it possible to reduce the gain slightly while effecting a major improvement in overload margin and residual noise. This is done by decreasing the gain of the preamplifier while increasing the gain in another section of the circuit.

The preamplifier is interesting in that it has three stages with equalisation occurring in the second and third; the first stage (Tr1) is aperiodic, ie, has a flat frequency response. Tr1 has negative feedback applied around it such that it is easy to change the gain while not affecting the input impedance or the DC conditions at the output of the preamplifier.

Thus the gain of Tr1 and the whole preamplifier has been reduced by reducing the collector-base resistor to 470k and the base-emitter resistor to 27k. This also improves the stability of the DC conditions in the preamplifier, although this was not a problem in the 132.

As such, this modification improves the overload margin of the preamplifier to the point where it will comfortably handle signals in excess of 50mV at 1kHz. This is adequate for the majority of magnetic cartridges now available.

To prevent strong RF signals being detected by the preamplifier, a 100pF capacitor is connected between base and emitter of Tr1. This is wired directly across the transistor on the copper pattern.

A problem encountered by several constructors was audible high frequency oscillation or even "sqegging" (periodic bursts of high frequency or supersonic oscillation) when the treble tone control was set to maximum boost. This can be cured by increasing the limiting resistors in series with each end of the treble control from 150 ohms to 1.5k. At the same time, a 390pF capacitor is connected from collector to base of Tr5 (in both channels) to limit the response above 20kHz.

The reduction in the amount of treble boost by these modifications is negligible and in any case, full treble boost is seldom necessary. If it is deemed necessary, it is indicative of other problems in the system — loudspeakers or cartridges deficient in high frequency response or maybe the listener is going deaf!

Another small change can be made to the tone control circuit to reduce interaction. "Interaction" refers to the change in level at mid frequencies when the highs and/or lows are boosted or cut. Ideally, interaction should be at a minimum. We recommend reducing the .0068uF capacitor (in the tone control circuit, both channels) to .0022uF. Again, the amount of useful boost or cut is not affected.

Incidentally, note that the voltage at the collector of Tr5 should be between 10 and 12V when measured with a 20,000 opv voltmeter. The voltage can be adjusted by varying the base bias resistors. To reduce the voltage, reduce the 3.3M and vice versa. On one amplifier the author modified, the easiest way to set the voltage to the correct range was to remove the 470k bias resistors. This reduces the bias stability but was easier than changing to another transistor which had higher beta.

The base coupling capacitor for Tr5 has been reduced to 0.1uF but this is not critical and need only apply to amplifiers that are being newly built.

Major changes have been made to the circuit around Tr6. Constructors will recall that this stage was arranged to provide a small amount of fixed bass boost at around 30Hz while also adding to the overall system gain. This was to compensate for the bass deficiency in compact speaker systems.

In the field, this feature has often caused problems of acoustic feedback and/or undue emphasis of turntable rumble. In a few cases, it also gave symptoms of low frequency instability.

We have completely revamped the circuit to provide a flat frequency response and additional gain to make up for the gain reduction in the magnetic preamplifier. About the only component which stays the same is the transistor. Note that no changes to the copper pattern of the printed wiring board are necessary, although a few wire links will need to be inserted to take the place of omitted components.

A 150pF capacitor was connected between the collector and base of Tr6 to roll off the response above the limits of audibility and this assures good stability.

No changes have been made to the power amplifier which has proved very reliable. We now recommend that Tr8 be an AY8140 or TT801 instead of the type BFY50 which is not entirely suitable in this position and is becoming hard to obtain anyway.

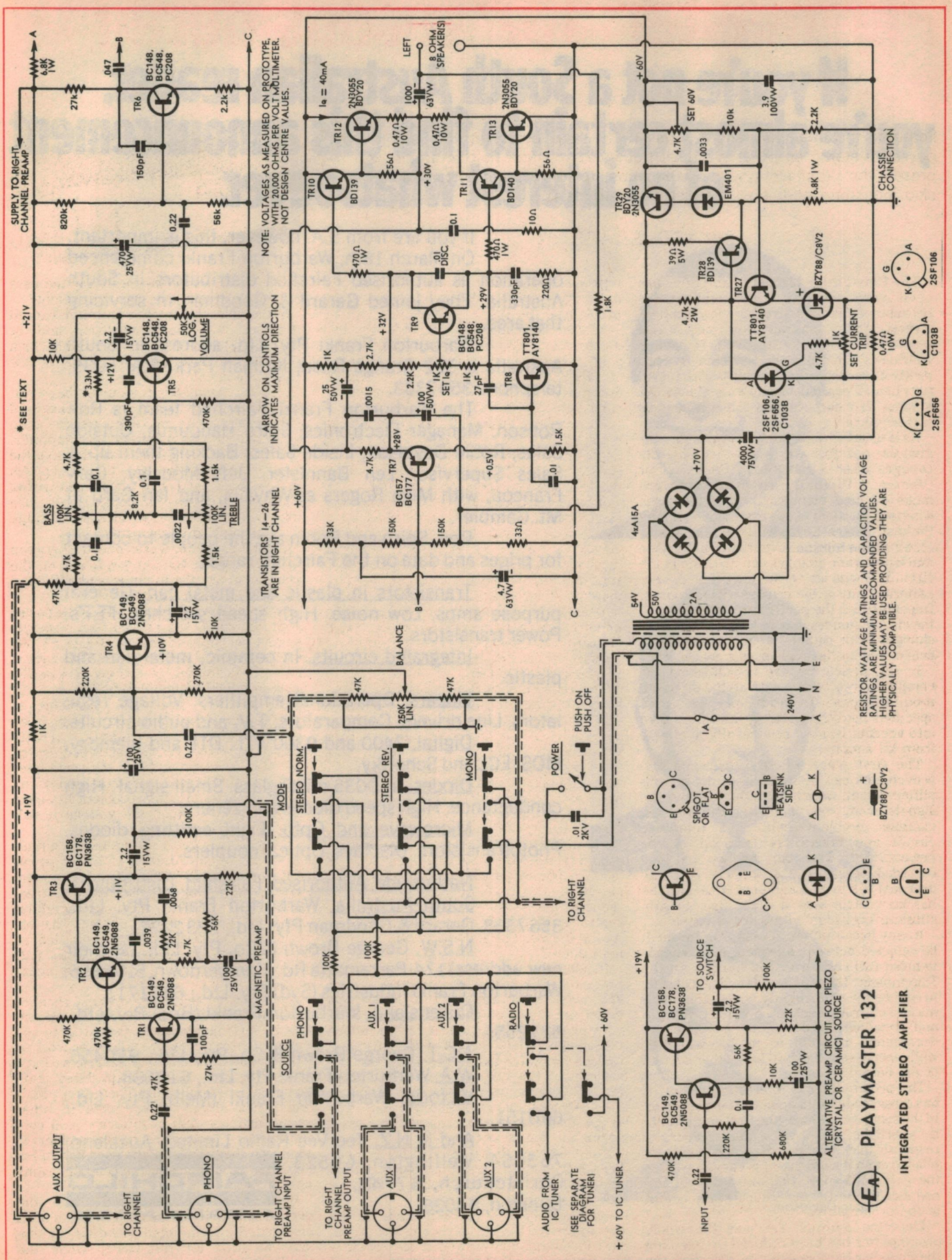
The greatest source of problems to constructors of the Playmaster 132 has been the protected power supply. Erratic triggering of the silicon controlled switch has often occurred and this has sometimes damaged every transistor in the supply and the zener diode. Another problem has been the inability to adjust the voltage to 60V with the preset potentiometer.

A major change to the regulator circuit has been the substitution of a low power SCR for the SCS. This should eliminate erratic triggering. Recommended transistor types for Tr27, the error amplifier transistor are TT801 or AY8140. The 10k resistor to the emitter of Tr27 is omitted, as this can apply reverse voltages to Tr27 when the SCR triggers and possibly cause damage.

Several other related component changes have been made to the regulator circuit. Again, no changes need be made to the copper pattern of the regulator board.

Throughout the circuit diagram, we have shown the new TO-92 encapsulated transistors where applicable. There is a pitfall which has already been noted in other recent articles, that of differing lead configurations. The way around this problem is to match the transistor the user has in his hot little hand to one of the base diagrams on the circuit.

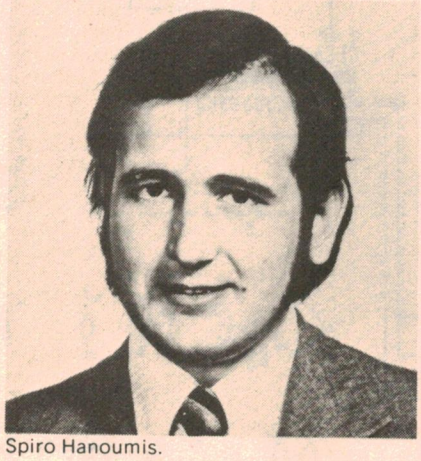
With circuit changes listed above, the overall sensitivity of the amplifier has been changed. Magnetic input sensitivity is now 3mV at 1kHz for full power while the auxiliary inputs are approximately 200mV for full power.



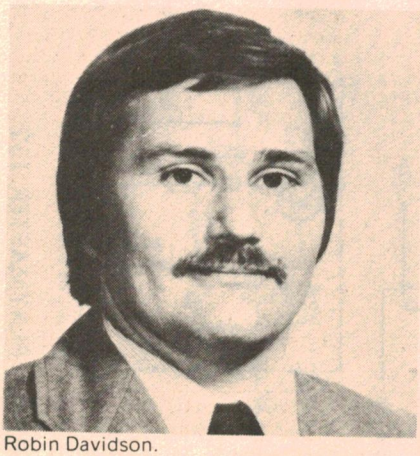
Above is the revamped circuit of the Playmaster 132 stereo amplifier originally published in June, July and August 1971.

If you're not a South Australian reader, you're almost certain to find this announcement of no interest whatsoever.

Ron Robson.



Spiro Hanoumis.



Robin Davidson.

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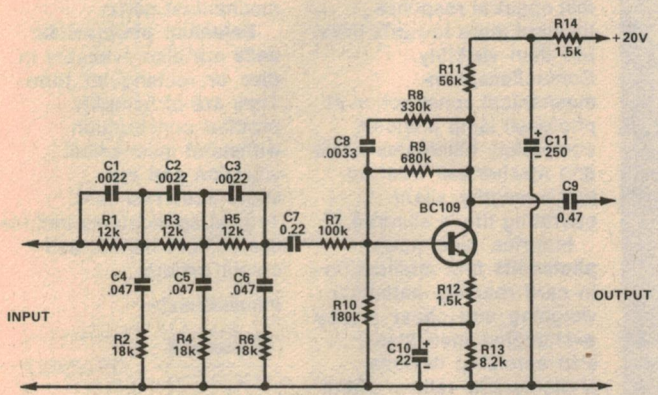
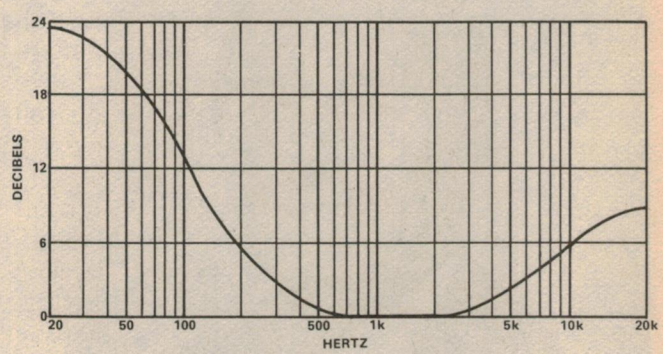
Circuit & Design Ideas

Interesting circuit ideas and design notes selected by the Editor from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsiblity cannot be accepted. Contributions to this section are always welcome.

Loudness Control





After building a stereo amplifier without a loudness control, I decided to design one and incorporate it in the new system. The circuit was designed primarily for use in a system where cheaper speakers are in use, to compensate for the poorer bass and treble response of these speakers. However, it was found that it gave a pleasant sound in a better system where the user wants to boost the bass.

The mid-frequencies gain has been reduced by 16dB, otherwise overloading of the power amplifier or speakers could occur when the loudness control is switched in. The circuit should theoretically be driven from a low impedance source but it was found to operate satisfactorily from a source impedance of 25k ohms. If the output of the loudness control is fed into a low impedance, C9 may have to be increased in value. If the treble boost is not required, C1, C2 and C3 may be omitted. The loudness control operates at a level of 250 to 500mV.

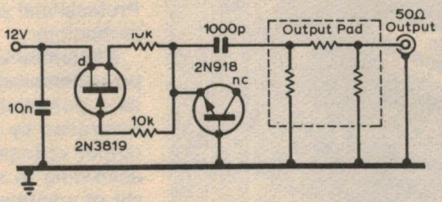
Bass boost is achieved by the low-pass filters R3 R2 C4, R5 R4 C5, R7 R6 C6, and by high frequency negative feedback via R8 C8. The treble boost is achieved by the high-pass filters R1 C1, R3 C2 and R5 C3.

(By Mr R. A. Hamel, 11A The Boulevarde, Epping, NSW 2121.)

Wide-band noise generator

We were interested to find a useful-looking noise source in "Electronic Engineering" and stemming from Prof G. Sinigaglia and Dr G. Tomasetti. It is claimed that this unit is virtually temperature independent, a most important characteristic when the source is to be used from time to time to check that there has been no deterioration in receiver performance.

The zener diode is formed from an inversely polarised emitter / base junction of a 2N918 HF silicon transistor which was found to provide "Incredibly high" noise



generation right up into the gigahertz region. The 2N3819 FET forms a current generator largely independent of temperature changes.

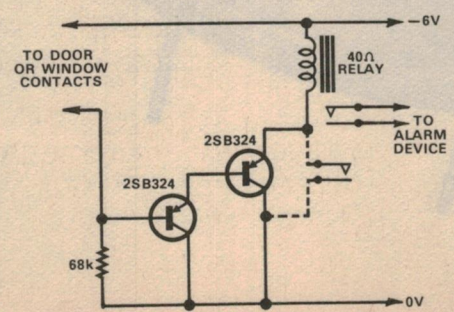
The noise output is stated to remain within about one per cent over the temperature range of 0 to 50 degrees C, and as a noise source the only drawback is that it needs to be calibrated against a primary source unless it is intended to be used just as a sensitivity check rather than to measure the noise factor of a receiver. The designers include an output pad to vary the output by known amounts and also to provide an output source matched to 50 or 72 ohms.

(From "Radio Communication".)

Economical burglar alarm

Here is a suggestion for a very economical burglar alarm. I used Japanese transistors salvaged from old radio sets. The transistors used may be either the 2SB prefix (PNP), or the 2SD prefix (NPN). Also, 2SA (PNP) or 2SC (NPN) types could be tried, if the relay coil you are using is not sufficient to overload them. The circuit will be used as shown for the PNP types but the battery polarity will have to be reversed for the NPN types.

As this circuit is activated by breaking the contacts circuit, it is suitable for application to door and window connections. If a break in the window or door contacts is



remade, the relay will revert to its unoperated position. To avoid this, the relay can be made self-latching by using the dotted wiring.

In the passive state, with the transistors shown, the current is of the order of 0.3mA. In the operated state, 100mA or so is drawn. The 2SB324 transistors shown in the circuit are approximately equal to the AC128. A suggested setup would be to use an Eveready 509 lantern battery as a power supply and the low current should give the battery a very long life. The alarm device can be left to the ideas of each individual.

(By Mr D. A. Scott, 32 Laburnum Street, Blackburn, Victoria 3130.)

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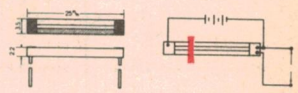
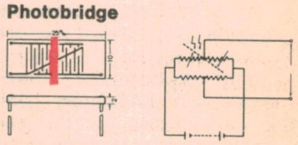
Photobridge (displacement detector for servo mechanisms). Designed for use in displacement detector circuitry in which element resistance is controlled by the relative position of a light admitting slit. Amongst its features are simple adjustment of the light beam and setting point, minimal effect from temperature and light level differences, extended service life and no mechanical noise.

Selenium photovoltaic cells are also available in disc or rectangular form. They are of humidity proofed construction, withstand mechanical vibration and are shortcircuit resistant. Typical applications include use in light meters and colour meters.

Photentiomatic



Photobridge



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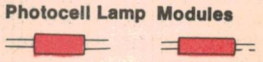

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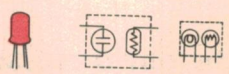

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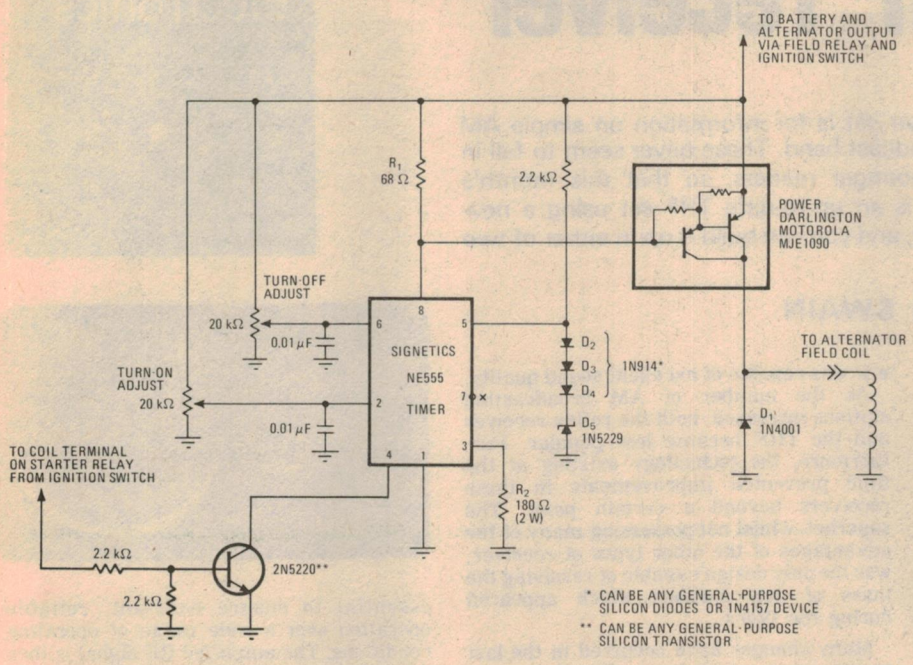
AC93/R1

IC timer as automotive voltage regulator



A 555-type IC timer, in combination with a power Darlington transistor pair, can provide low-cost automotive voltage regulation. Such a regulator can even make it easier to start a car in cold weather.

As the diagram shows, the circuit requires very few parts. The value of resistor R1 is chosen to prevent the timer's quiescent current, when the timer is off (output, pin 3, low), from turning on the Darlington pair.

If the battery voltage becomes too low, the timer turns on, driving its output high and drawing a current of about 60mA through resistor R2. This causes a sufficient biasing voltage to be developed across resistor R1 and the Darlington turns on, supplying the energising current to the field coil of the car's alternator. Diode D1 suppresses the reverse voltage of the field coil when the Darlington pair is turned off.

The regulator's low-voltage turn-on point is fixed by setting the voltage at the timer's trigger input (pin 2) to approximately half the reference voltage existing at its control-voltage input (pin 5). The high-voltage turn-off point is set by making the voltage at the timer's threshold input (pin 6) equal to the reference voltage at pin 5. At 25 degrees C, the turn-on voltage is typically 14.4V, and the turn-off voltage is typically 14.9V. These voltage levels, of course, should be set to match the charging requirement of a given car's specific battery-alternator combination.

The value of the reference voltage is established by the diode string, D2 to D5; here it is approximately 5.9V. The output voltage has a negative temperature coefficient of -20V / degree C.

A transistor and a couple of resistors can be added to the circuit for better cold-weather starting. These parts are connected to pin 4. During starting, the transistor holds the timer in its off state, lightening the load on the car's cranking motor. (To prevent radio interference, a 10uF capacitor can be connected from the Darlington emitter to ground.)

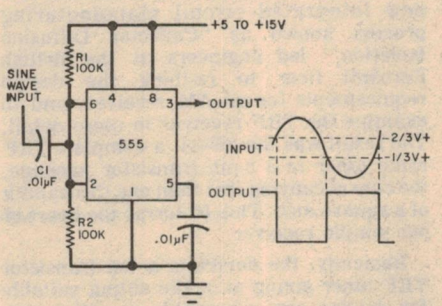
By T. J. Fusar, in "Electronics".)

Schmitt trigger or bistable buffer

Aside from its basic use in timing functions, the 555 IC can be applied to advantage in other switching circuits. One example is the Schmitt trigger circuit. In this circuit, the two comparator inputs (pins 2 and 6) are tied together and biased at half of the applied DC voltage through the voltage divider made up of R1 and R2. Since the upper comparator (pin 6) will trip at 2 / 3 of the applied DC and the lower one at 1 / 3 of the applied voltage, the bias provided by the resistors R1 and R2 is centred within the comparators' trip limits.

A sine wave input of sufficient amplitude to exceed the reference levels causes the internal flip-flop to be set and reset. In this way, it creates a square wave at the output. As long as R1 is equal in value to R2, the 555 will be automatically biased correctly for almost any supply voltage. Note that the output waveform is 180 degrees out of phase with the applied input sine wave. Because of the high output current capability of the 555, this circuit can be used to good purpose as a signal shaper / buffer circuit.

Such a circuit can also find application if you have a sine-wave-only audio generator and you would like to have a simultaneous square-wave output. The major advantage of this circuit is that, unlike a conventional multivibrator type of squarer, which divides the incoming frequency in half to square it, the Schmitt trigger simply squares the input without changing the frequency. A circuit of this type can easily be installed within almost any audio generator.



By modifying the input time constant of the circuit (reducing the value of input capacitor C1 to .001uF, for example) so that input pulses will be differentiated, the arrangement can also be used either as a bistable device or to invert pulse waveforms. In the latter case, the fast time constant of the combination of C1 with R1 and R2 causes only the edges of the input pulse or rectangular waveform to be passed. These pulses set and reset the flip-flop, and a high-level, inverted output is the result.

(By Walter G. Jung, in "Popular Electronics.")

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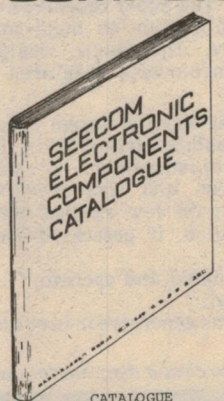

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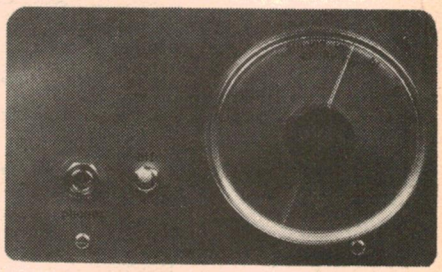
For beginners: a simple TRF receiver

Elementary Electronics

One of the most frequent requests we get is for information on simple AM radio receivers and tuners for the broadcast band. These never seem to fall in popularity, particularly among the younger readers, so that this month's project should really hit the spot. It is an up-to-date TRF set using a new "receiver-on-a-chip" integrated circuit, and you can build it up in either of two versions.

by GREG SWAIN



This receiver must surely be one of the simplest projects that we have published to date, despite the fact that it uses ten "transistors." The secret of its simplicity lies in the use of a new integrated circuit, the ZN414, which is virtually a complete TRF receiver in itself. However, before we begin to describe the constructional details of our receiver, it may be as well to examine a few historical facts regarding TRF receivers in general.

Radio receivers employing the superheterodyne principle have dominated the radio industry for the past 30 years. Prior to the superhet achieving complete acceptance, several other types of receiver designs enjoyed varying degrees of popularity, the main alternatives being the tuned radio frequency (TRF), the reflex and the super-regenerative designs.

Reflex receivers were capable, with careful use, of extremely good results. However, they were quite difficult to build and stabilise. As with any high gain device where feedback is encouraged, instability often resulted, making the receiver unpredictable in use. The super-regenerative receiver was even harder to build and operate correctly, the basic design radiating interference over a wide area if misused.

The TRF receiver was the design which enjoyed almost absolute exclusivity in the early days of broadcasting. It was reasonably sensitive, and was selective enough to separate the few stations then operating. In addition, it possessed four other advantages:

- it was simple to build and operate;
- it was economical;
- no interference was generated in use; and
- it was capable of excellent sound quality.

As the number of AM broadcasting stations increased, both the reflex receiver and the TRF became less popular. Furthermore, the technology existing at the time prevented improvements to these receivers beyond a certain point. The superhet, whilst not possessing many of the advantages of the other types of receiver, was the only design capable of resolving the mass of new stations which appeared during the 1930's.

Many changes have occurred in the last twenty years which have altered some of the design criteria for AM receiver designs. The function of AM broadcasting has altered quite markedly, the majority of people today using an AM receiver solely to listen to four or five major broadcasts. The average listener has no interest in listening to distant stations or foreign broadcasts.

These facts, coupled with the advent of a new integrated circuit manufacturing process known as "Collector Diffusion Isolation," led engineers at the British Ferranti firm to re-think the design requirements for an AM receiver, and to examine the TRF receiver in more detail. The result was the ZN414, a complete TRF radio tuner in a 3-pin transistor package, the chip occupying less than one thousandth of a square inch. This IC forms the heart of our simple receiver.

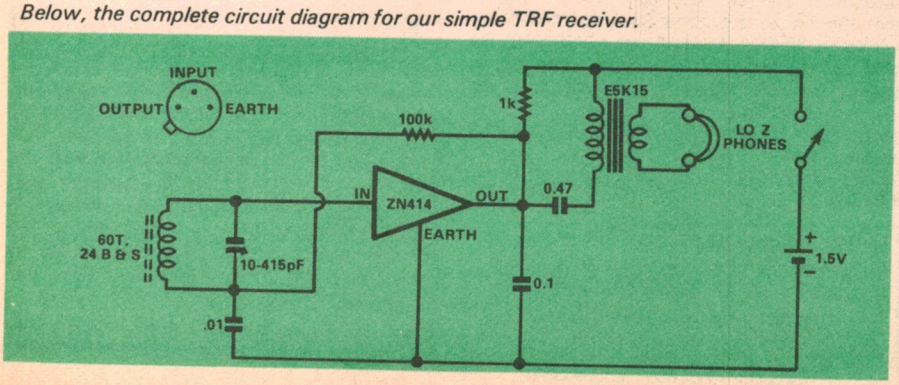
Basically, the device is a ten transistor TRF tuner giving an audio output suitable for driving any reasonably sensitive amplifier. To obtain the high selectivity needed in a TRF design, an extremely high input impedance is provided. The radio frequency (RF) signal is amplified successively, using four stages of high stability. These are essential to ensure constant, reliable operation over a wide range of operating conditions. The amplified RF signal is then detected and used to derive automatic gain control action (AGC). Finally, the audio component of the detected waveform is fed through a low pass filter to drive an external amplifier or crystal earpiece.

If one elects to use the popular low impedance (hi-fi type) headphones, this requires that an impedance matching device be used between the tuner and the headphones. Our solution was to use a speaker transformer (Ferguson type E5K15) which, as the type number suggests, has a primary impedance of 5,000 ohms, a secondary impedance of 15 ohms. Any similar speaker transformer would be suitable. While a crystal type earpiece could be used, the performance is nowhere near as good as that from the low impedance "hi-fi" types, which are available for as low as $3.75.

Instead of a long wire aerial and an earth, this receiver uses a loopstick (ferrite rod) aerial, enabling the set to be used anywhere. Nothing is more annoying than having a set tied to an aerial and earth, unless there is good reason for doing so. In parallel with the loopstick is a tuning capacitor. A standard 10-415pF single section type may be used, either purchased new or salvaged from an old radio. The alternative version of the set uses a miniature plastic dielectric capacitor.

The 1k resistor placed in series between the positive supply rail of the 1.5V battery and the output of the ZN414 is used to derive AGC action. It is not enough to wind a high "Q" aerial coil and expect optimum performance automatically. If the AGC action is incorrectly set, stations will either occupy an inordinately large bandwidth, or will not be received without undue noise. In addition, the audio output may well reduce with increasing signal strength due to the RF gain of the ZN414 being too high. This causes clipping of the modulation waveform, resulting in reduced output and high distortion.

Below, the complete circuit diagram for our simple TRF receiver.



In practice, we found that the receiver works well with the AGC resistor fixed at 1k. However, individual readers may have to alter this value should the above symptoms be experienced.

One of the characteristics of the TRF circuit is that, even with a high "Q" tuning mechanism, a very strong station will swamp the circuit. This condition will result in poor selectivity and possible high distortion levels. Rotation of the receiver to find a null is the most effective way to solve this problem. Alternatively, the supply voltage may be reduced.

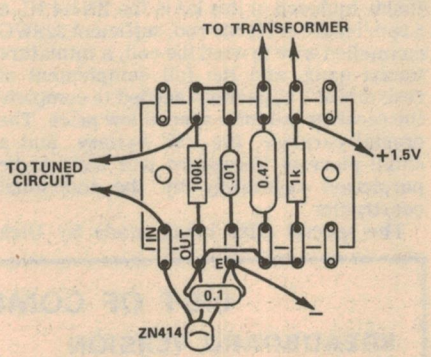
To keep the construction of this receiver as simple as possible, keeping in mind our objective for a simple beginner's project, we initially elected to use the breadboard design approach. The major components, with the exception of the headphone socket and the on/off switch, were mounted on a piece of 5/8in thick particle board, the dimensions of which are 16 x 10.5cm. A front panel was fashioned from a piece of scrap aluminium, and this accommodates the on/off switch and the headphone socket, together with the dial and station identifications.

Construction of the receiver may begin with the construction of the loopstick. Ferrite rod is sold in 200mm lengths — and as we need only 100mm, it must be divided. The rod is cut in a similar manner to glass: file a nick right around the circumference, then snap it carefully by hand. Take care not to drop it, as ferrite is brittle and will break easily.

Wind a layer of insulation tape over the ferrite to protect the enamelled wire, then anchor the wire(24 B&S) about 2cm from one end (leave about 10cm wire over) and close wind 60 turns onto the rod, making sure that the turns are tight. Anchor the winding with insulation tape, again leaving about 10cm of wire for connection to the tuning gang. No taps are required on the coil.

The tuning capacitor is the first major item to be fitted on the board. It is mounted so that the centre of the shaft is approximately 4.5cm from the right hand edge of the board. To keep costs down, you may be able to salvage a tuning gang from an old discarded radio. However, it is probable that it will be physically larger than the gang we have used (though it will probably still have the same capacitance), and will almost certainly be a double gang type. If so, the layout that we have used will have to be modified somewhat to ensure that all components will fit on the board.

If you do salvage a gang from an old set, make sure that the plates of the gang do not touch anywhere over its travel. This is best done using an ohmmeter. The fact that the gang is a double section type is of no consequence (except in terms of size and physical layout) — simply ignore one section, unless you aim to try listening on frequencies down past the low end of the broadcast band.



The wiring diagram for the tagboard. Be careful to ensure correct connections for the ZN414.

The battery holder and transformer can now be mounted as shown in the photograph. Note that other transformers may be more bulky than the transformer we have used (Ferguson E5K15), in which case the transformer will have to be mounted slightly to the left of its present position. Make sure that you leave sufficient space between the transformer and the front of the board (at least 3.5cm) to enable the tagstrip to be mounted.

The next logical step is to wire the tagstrip according to the circuit and the layout. This accommodates all the minor components, including the ZN414 integrated circuit. The tagstrip is then simply screwed to the board immediately behind the front panel and adjacent to the tuning capacitor.

Because some readers may experience difficulties in obtaining conventional double-sided resistor tagboard, we used a relatively new product — etched copper laminate tagboard. This is similar to conventional tagboard, but has etched copper pads instead of the usual rivetted tags. All holes and dimensions of the printed board version are exactly the same as with conventional tagboard. The new tagboard is available from Kitsets Australia. and is priced the same as conventional tagboard. Either type of tagboard can be used in the construction of this receiver.

Two small brackets are used to mount the ferrite rod. These were bent up out of a piece of scrap 22g aluminium, and have dimensions as shown on page 86 of the March issue of E.A. They are screwed to the back of the board immediately behind the battery holder and the transformer. The rod is held on the brackets by two rubber grommets which are slid onto either end of the rod. The distance between the mounting brackets should be approximately 9cm. However, this is not critical as the grommets can be moved along the rod until they fit.

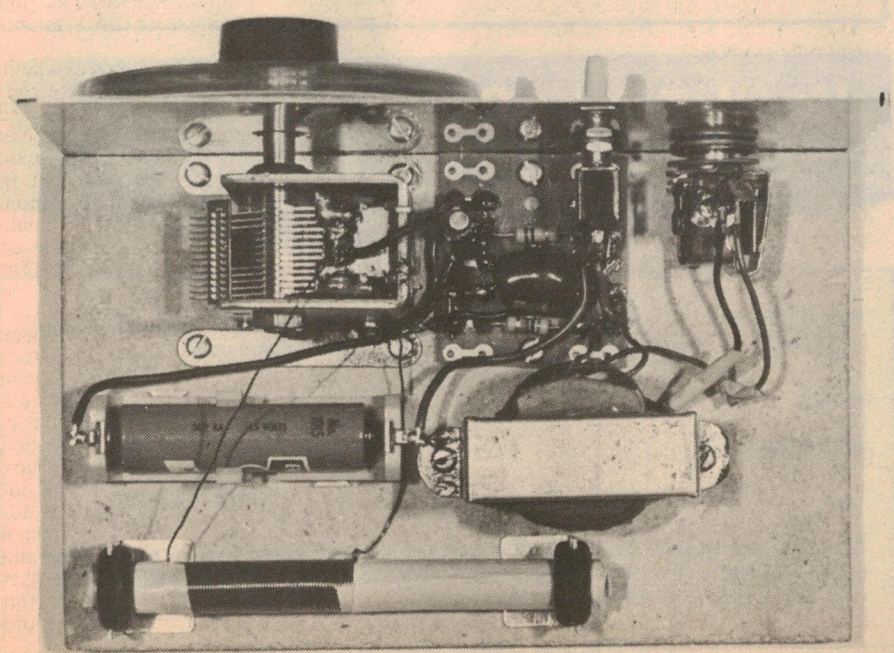
Having mounted all the major items, including the tagboard, all leads can now be cut to their correct length and connected. First, connect the leads from the tagboard to the tuning capacitor, then the flying leads from the tuned winding to the same points. The battery, on/off switch, transformer, and headphone socket can also be connected at this time. Make sure that the leads to the on/off switch are left long enough to enable these latter two items to be mounted on the front panel.

The wiring of the headphone socket warrants special mention where hi-fi stereo phones are to be used. It is important that the socket be wired so that both phones of the stereo headset receive the signal. To do this (and also to present the maximum impedance to the output transformer), the phones are wired in series. Simply use the socket tags which connect to the tip and ring of the plug, and ignore the tag which connects to the main body of the plug.

With the wiring side of our simple TRF receiver now completed, all that remains is the front panel. The panel used on the prototype was fashioned out of a piece of 22g aluminium, the dimensions being 16 x 9.5cm. Three holes need to be drilled in this front panel — one for the tuning capacitor shaft, a second for the on/off switch, and the third for the headphone socket. The holes for the tuning capacitor shaft and the headphone socket were drilled to 3/8in, whilst a 1/4in drill is used for the on/off switch. All holes should be de-burred with a large drill.

We used "Letraset" for all front panel marking and labelling, after which a fine coat of clear enamel was applied to protect the surface. If desired, the front panel can be dressed with a wire brush before labelling. A simple plastic "handspan" dial was fitted to the tuning capacitor shaft.

Having completed our breadboard version of the TRF receiver, we began to examine the possibility of miniaturising the design layout. One obvious solution to the problem of miniaturisation is the



This photograph of the completed receiver clearly shows the disposition of the major components.

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elimination of the bulky transformer, by using a high impedance crystal earpiece together with the use of a miniature tuning capacitor and a more compact loopstick. The use of a 1.3V mercury cell in place of the standard 1.5V penlight battery would also make for a more compact design, although at an increase in cost.

Shortly after we started thinking along these lines one of our well known advertisers, Dick Smith Electronics Pty Ltd, contacted us with the news that they were prepared to supply a basic kit for the TRF tuner. Included in this kit is the ZN414 IC, a 5.5cm length of ferrite rod, sufficient 32SWG enamelled wire to wind the coil, a miniature tuning gang, and the full complement of resistors and capacitors needed to complete the receiver, all for a special low price. The crystal earpiece, the 1.5V battery, and a small piece of Veroboard will have to be purchased separately by the individual constructor.

The special offer being made by Dick Smith Wholesale Pty Ltd is that, by enclosing the coupon on this page with their order, E-A readers will be able to buy the basic ZN414 receiver kit for the special introductory price of $6.75 plus 50c for packing and postage. Considering the normal advertised price of the ZN414, this represents very good value for money.

Spurred on by this offer, we elected to build up a second version of the set on a piece of Veroboard with the objective of miniaturisating the design as much as possible whilst retaining a neat and easy-to-follow layout. The basic circuit for the miniature version is exactly the same as for the breadboard version, except that the transformer and its associated 0.47uF coupling capacitor are eliminated; the output to the crystal earphone is simply taken across the 1k AGC resistor.

The aerial coil used in the miniature version also differs slightly from that used in the original breadboard design. It consists of 85 turns of 32SWG enamelled wire,

LIST OF COMPONENT PARTS

BREADBOARD VERSION

SEMICONDUCTORS:
1 ZN414 IC

RESISTORS: ¼W or ½W 5pc
1 1k
1 100k

CAPACITORS:
1 0.01uF polyester or ceramic
1 0.1uF polyester
1 0.47uF polyester
1 10-415pF single section tuning gang

MISCELLANEOUS:
1 piece of breadboard (16 x 10.5cm)
1 aluminiun front panel (16 x 9.5cm)
1 10cm length of ⅜" ferrite rod
1 speaker transformer 5k to 15 ohms (Ferguson E5K15 or similar — see text)
1 stereo headphone socket
1 on/off switch
1 6-lug section of tagstrip (see text)
2 rubber grommets
24 b&S enamelled copper wire
Thin hookup wire
1.5V battery
"Letraset" for marking front panel
1 handspan plastic dial
Screws, solder, scrap aluminium for brackets, etc.

VEROBOARD VERSION

1 kit from Dick Smith Electronics comprising ZN414 IC, length of ferrite rod, 32SWG enamelled wire, miniature tuning gang, 1 x 1k ¼W resistor, 1 x 100k ¼W resistor, 1 x .01uF capacitor, 1 x .01uF capacitor
1 miniature crystal earpiece (plus socket if required)
1 1.5V battery (Eveready 1015)
1 piece Veroboard, 0.2in pitch, 6 x 5cm
1 on/off switch
Thin hookup wire

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the ends being soldered directly to the board. A small strip of insulation tape is used to further secure the aerial rod on the board.

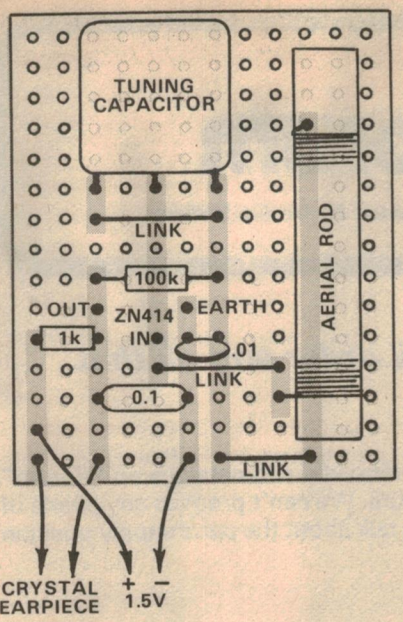
We managed to fit all components, excepting the battery, the earpiece and the on/off switch (if required), onto a piece of Veroboard measuring just 6 x 5cm. No doubt a more compact arrangement could be achieved by standing resistors on end, etc. However, this is left to the individual constructor, as are the cabinet mounting and battery connection details.

Naturally, there is no need to adhere to the physical layouts we have used. However, if you do decide to alter the layout, certain design precautions should be followed to ensure stable, consistent operation. The most important of these are as follows:

- the output decoupling capacitor should be soldered as near as possible to the output and earth leads of the ZN414;
- all leads should be kept as short as possible, especially those in close proximity to the ZN414; and
- the "earthy" side of the tuning capacitor should be connected to the junction of the 0.01uF capacitor and the 100k resistor.

Whether you decide to follow one of the layouts we have used or decide to design your own layout, little difficulty should be experienced in setting this simple little receiver into operation. We suggest that the beginner start with the breadboard version and progress to the miniature version. In fact, it would be a real challenge to see just how small you can make this receiver.

You don't have to use it purely as a simple receiver, either. It would be just fine as a tuner for tape recorders, PA systems, and any other similar applications. With good sensitivity and fairly wide bandwidth, it can give remarkably high quality reception when used within a reasonable distance from the stations.

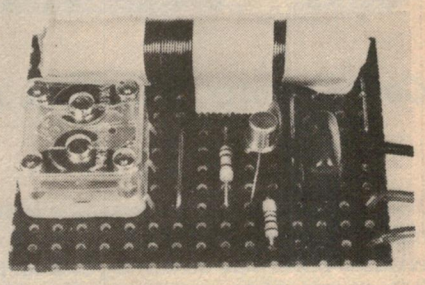


Incidentally, there's no reason why you shouldn't adapt the design to tune to other frequencies, as the ZN414 is designed to operate normally over the range 150kHz to 3MHz, which extends both well below and well above the broadcast band. You may even be able to push individual devices further still. There's plenty of room for experiment.

All you will need to do to modify the design for different frequency ranges is to change the tuned circuit — the aerial coil and the tuning capacitor. In most cases, the simplest approach will be to simply wind new coils for the aerial rod. To go down below the low frequency end of the broadcast band, wind on more turns than the figures we gave earlier. This will take you down to the "long waves" area of the spectrum, inhabited mainly by aircraft weather beacons and similar services.

On the other hand if you wind a coil with fewer turns than we have suggested, this will move your tuning range up above the broadcast band, into the "shorter waves" region. With a little experimenting, you should be able to listen in to radio amateurs on the 1800kHz or "160 metre" amateur band, and perhaps also to ship-to-shore and other marine band services in the region above 2MHz.

Adapting the design to receive on different frequencies is far easier than with either a superhet or a regenerative set, as there is only one simple tuned circuit to modify.



This wiring diagram of the veroboard version, together with the above photograph, should make construction a straightforward process.

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Forum

Conducted by Neville Williams

Components, stockists, mail order and all that . . .

The emphasis in this issue seems to be on bits, kits and catalogs so "Forum" may as well get into the act, for good measure. We can't promise any pearls of wisdom but it may do some good simply to talk about the parts supply position in a matter-of-fact, unemotional way.

Let's be quite frank:

We do get letters, particularly from country readers, complaining that they have been treated poorly by one supplier or another. As often as not, they begin or end with the observation that "it wasn't like that in the old days."

It wasn't, either! You could write away for a thingo, your letter would be delivered predictably, and the said thingo would turn up a few days later, on the dot, well packed, well cared for, precisely what you asked for.

No talk of shortages, no abbreviated procedures — every transaction aimed at encouraging further buiness.

Those were the days of the friendly grocer, who personally reached down your requirements from the shelves, managing to produce a neat parcel of brown paper and string from the most incompatible elements.

Carpenters, plumbers? They were available on call, and they knew all the answers because they had been dealing with the same products and problems all their lives.

What happened to this "idyllic" age?

Well, the grocer, the carpenter and the plumber — like the rest of us — decided that they wanted a lot more money for a lot less work, and a variety of fringe benefits as well.

That was only the beginning.

The way things are now, we can't afford the "friendly grocer." Instead, we have supermarkets, where we pick up our own groceries and pay a check-out girl on the way out.

Carpenter, plumber? They'll come — when they can get around to it — and you pay a call charge for the privilege of having them knock on your door.

Progress? maybe, or maybe not, but that's hardly the point. It's the way things are.

What has this to do with electronics parts dealers?

Everything.

They're very much a part of the economic scene, up against the cost, the scarcity and the mobility of the modern labour force. No matter how well intentioned, it is just not possible for them to cope with the details, the niceties and the courtesies that characterised "the good old days."

Maybe this has something to do with "the quality of life" which ecologists and sociologists are fond of talking about.

But before we start feeling affronted or deprived, let's consider another aspect.

We're all keen to see new devices, particularly if they do things more economically, or do more things for the same outlay. If we, as a magazine, don't react to the new devices, we're soon reminded of the fact by readers. Whether we admit it or not, we are all very much a part of the fast-moving technological scene.

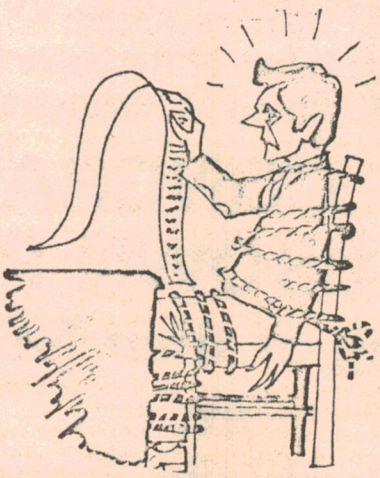
Fast moving?

So fast that product lines can come and go within a few months. So fast that they can be superseded by the time would-be users decide to "give them a go."

And in what variety they come.

Time was when a "point one condenser" was a "point one condenser," an inch or more long, half an inch in diameter, in two or three well known brands. They were bulky, they weren't very reliable but they never posed a supply or identity problem.

Now "point ones" are available with paper dielectric, polystyrene, polyester and ceramic, in a range of voltages and tolerances, and in sizes from the old-fashioned proportions to miniatures that you could lose in the cuff of your pants — if pants still had cuffs! They're all "point ones" but they're seldom interchangeable, for one reason or another.



The problems discussed in these columns are not by any means unique to Australia. This is how "Everyday Electronics" saw the situation in the UK in November 1971. The caption read: "Pricing a long list can tie up a staff member for quite a while!"

Are you and I satisfied with any "point one" we can get? Not on your sweet life! We're building a state-of-the-art whatnot and we must have slantwise mounting polyceramica capacitors to complement the new LSI active inductors. What's more, if our normal stockist can't oblige, we'll take our business to one who can!

Imagine what a problem this poses for the stockist, when taken across the board. He faces a potential demand for an enormous range of parts, many of them with specific areas of usage and many of them smaller than their own type numbers.

Perhaps it wouldn't be so bad if they were in reliable supply, but they aren't. The industry has been through a period of world-wide shortage, which is still with us.

What a ludicrous situation, when we have stockists and manufacturers alike searching the place for ordinary 1k ½W resistors. Or when members of own staff can't buy ¼in long ⅛in Whitworth screws, without organising an expedition!

And what a ludicrous situation it is when there is constant debate as to whether it is "safe" to commit anything to the post.

You don't have to be mad to be an electronics stockist, these days, but I'm sure it would help.

There is evidence that the parts problem reached some kind of a peak towards the end of last year. Not only was there a world shortage but it caught suppliers and stockists with methods and concepts geared to the "years of plenty." The shortage produced a crisis which, in turn, has forced a complete overhaul of methods.

One of the areas stockists have had to look at is the tradition of accumulating back orders and holding them, along with remittances, against the assumption that the order will ultimately be fulfilled — obeying the understandable urge to give service.

But, in present circumstances, as the hold-ups drift from days into weeks, and the pile of back orders grows, several things happen: they clog up the system and slow the turnaround of other orders, even where no shortage is involved. They also do dreadful things to the morale of the staff; why get excited about orders held up a couple of days, when there's a stack of others which have been waiting for weeks for a shipment, or a wharf dispute to end?

And, all the while, the customer out in the mulga is getting progressively more hopping mad. He writes a letter of inquiry, then a registered letter, follows it up with a reply paid telegram, and maybe a phone call or two. Each becomes more abusive than the last, ending with a vow never to spend another cent with the particular supplier, even if he was the last one on the face of the earth!

We can understand how he feels, particularly if each inquiry is not met with an individual acknowledgment. We can also see the supplier's problem, because every such reply costs the best part of two dollars. It doesn't take too many such letters to cancel the profit of a transaction.

Two dollars?

I know it sounds a lot but it isn't too hard to justify. We face precisely the same problem with respect to our own information service.

These days, in a major city, it costs over $100 per week to employ a typiste (salary + leave + sickness + insurance + superannuation, &c). It would be a good typist indeed who could receive a hundred letters per week, check previous correspondence for each, ascertain the present situation, compose and type a reply, post and re-file. That's more than a dollar per letter for her time alone, to which must be added the time of people with whom she has to consult, most of whom will be in a higher salary bracket.

By the time stationery costs and postage are added, plus oblique overheads, the figure of $2 would be low rather than high. One stockist to whom I talked while writing this told me that he has been employing one person, full time, just to keep track of orders held up by supply problems. Financially, he comes out of the operation backwards!

The same is true of situations where a customer phones in, long distance, and expects the supplier to phone him back with information about an outstanding order — and not necessarily a large one.

To quote one supplier: "Would you believe Perth? Or New Guinea?"

It is because of all this that stockists are trying to minimise or eliminate altogether the accumulation of unfilled orders. They are tending to gravitate towards a system which works something like this:

COUNTER SALES: Customers are warned about shortages which might affect a project on hand. Forward or conditional orders, and promises to obtain problem components are avoided as far as possible. Whether or not the customer buys the immediately available components is up to him.

MAIL ORDER: Incoming cheques, money orders, &c are recorded and banked by clerical staff on receipt. (It is neither wise nor practical to retain monies in the office, pending decisions by technical and despatch personnel).

AVAILABLE ITEMS: These are despatched, hopefully within 24 hours, accompanied by the necessary sales document.

NON-AVAILABLE ITEMS: If almost immediate delivery cannot be promised, the customer is advised that certain items are not available, and that the order in respect to those items will be cancelled, either immediately, or automatically after a limited period. Outstanding orders are not allowed to accumulate on file, generating bad will and tying up the customer's money.

REFUNDS, CREDIT: Monies may be refunded immediately or, alternatively, the customer may be advised that the supplier holds a certain figure to his credit. The customer can re-order the missing component(s) at a later date, when there is some indication that they may be available, or he may use the credit for other items or request a refund in cash.

QUOTES: Where these pose too much of a problem in terms of staff time, the customer may be supplied with a catalog and requested to work out details for himself.

KITS: Procedures differ for complete kits, as distinct from part kits or random lists of components, mainly because kits constitute a single standardised transaction. Customers may be given the option of awaiting the complete kit or receiving the available sections so that they can get on with the job.

As we said at the outset: "It's not like the good old days." However, stockists are accepting the view that it is better to admit to shortages and hold-ups and to go on from there, rather than to maintain the fiction that all is sweetness and light.

In discussing the emerging situation with stockists, we got the following typical responses to our questions:

What is the general attitude of customers to present-day shortages and hold-ups?
Some get really abusive but most customers are remarkably patient — which they need to be if a particular component is in really bad supply.

The familiar problem of scrawled signatures as seen by "Everyday Electronics." They described some of them as "halfway between the Plessey trademark and an invitation in Arabic to visit the Cairo museum."

The abusive ones: do you find that you lose them as customers?
Sometimes. But we get the ones who are mad with somebody else!

How do customers react to the idea of cancelling outstanding orders?
In general, it leads to fewer problems than having a customer wait on you, while you wait on a supplier, who might be waiting on somebody else. It leaves the customer free to shop around.

Doesn't the parts shortage endanger the whole future of electronics as a hobby?
It would, if the problems you've been talking about were unique to electronics. But they're not. It simply means that more ingenuity has to be directed, these days, towards overcoming shortages and rising costs.

Will it embarrass you as a supplier if we discuss the parts problem on the terms proposed?
On the contrary, we'd be delighted. When we tell a customer we're held up for 1k resistors, they think we're putting them on. If you talk about the problems, they might believe you.

Are they really going to believe us, or are we going to cop letters from customers who still think they're getting a raw deal from stockists?
Sure you'll get letters but, honestly, we're doing the best we can to keep our customers as happy as we can. That's the only way we stay in business.

Is there anything that customers can do to minimise problems and delays?
Ask your readers to print their name and address, including state and postcode on all correspondence. Signatures are fine, in their place, but they're often undecipherable to a stranger. The same goes for carelessly written addresses.

And that seems to be as good a place as any to draw these remarks to a close — for the time being.

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The Serviceman

Who should replace the speaker?

We tend to take it for granted that most reputable firms will stand by their products if proved faulty in manufacture. But a recent experience indicates that a customer can be the unwitting victim of behind-the-scenes deals.

A few months ago (February 1974) I related a story concerning a guitar loudspeaker, and the customer's complaint that it produced gross distortion when first connected to his new guitar amplifier.

While, at first, I suspected that he had damaged the speaker by overloading it and also using it without an enclosure, subsequent investigation revealed that the speaker was, in fact faulty. A "foreign body" — more precisely a fragment of pole piece casting — had somehow found its way into the assembly and was being held by magnetic attraction alongside the annular gap, where it fouled the voice coil.

The result was a jammed movement and a badly mutilated voice coil and voice coil former. Having established that much I contacted the manufacturer's local representative and asked him to drop in and have a look at it but, at the time of writing the February article, he had not had time to do so.

Subsequently he did turn up, and we removed the cone and voice coil completely for a better look at the situation. This also enabled me to take some photographs of the relevant parts, and these are reproduced herewith.

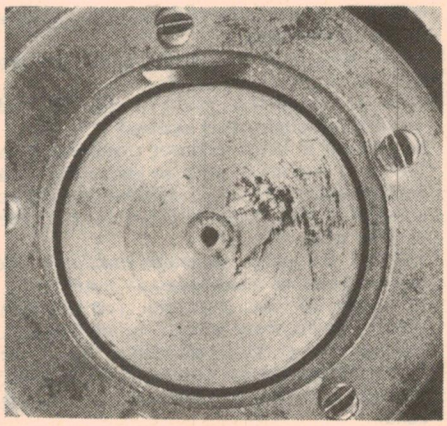
The representative was frankly puzzled. It was the kind of thing which, in theory, could not happen. In fact, if anyone had suggested that it could, without evidence to support the idea, he would have dismissed it as virtually impossible. But, with the evidence before him, there was little he could do other than accept the situation without trying to explain it.

But the more important immediate issue was what the makers were prepared to do about it. While it was useless to deny that it was a manufacturing fault, there were a number of other factors which, in the strict legal sense, absolved them from any responsibility.

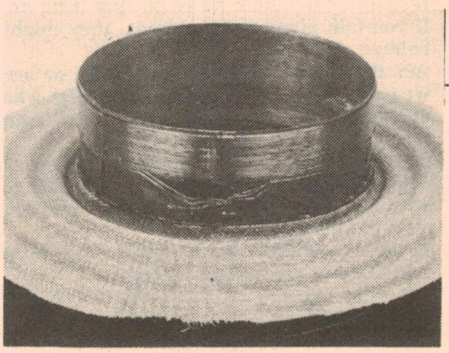
The first was that the speaker was a superseded model. In spite of it having been purchased only a few weeks before being put into service it was, in fact, one that had not been made or marketed for the past two years. Thus it was well outside any guarantee period which might have applied to it.

The second point was that it had not been purchased from one of the maker's authorised dealers. As far as we could determine the wholesaler from whom the speaker had been bought had, in turn, bought a job lot of superseded speakers from an authorised dealer. He had subsequently sold them as a "special" at something below the new price.

It seemed to me that this second point had little to do with the price of fish; it didn't alter the fact that the speaker was faulty as made — and I said so. The rep agreed, in part, but made a further point. Had the customer bought the speaker from an authorised dealer he would, first, have been advised that it was a superseded model and, second, been charged much less than the "special" price he had actually paid for it. Thus he would at least have known the risk he was running and could have evaluated it against the price asked.



The annular gap of the faulty speaker, showing the fragment of metal (top) where it was found. How it happened to be sealed in this part of the speaker is a mystery.



The damage caused by the fragment of metal. The winding is distorted and the aluminium former torn. Strangely, the voice coil remained continuous, at least until it was removed for examination.

Finally, the fact that I had intervened in the sequence of events complicated things from an administrative point of view. I could hardly make an official claim since I had not sold the speaker in the first place. The firm which did sell the speaker could not make a claim because they were not authorised dealers, nor had they been approached with the faulty speaker. Finally, there was no precedent for the representative to deal directly with the customer, even assuming that this was convenient, which it wasn't.

In the face of all these arguments I stuck to what I felt were the two really pertinent points; (1) the fact that I had discovered a fault which, otherwise, would almost certainly have been written off as due to abuse by the user and (2) the fact that the fault was undeniably a manufacturing fault and that the time the speaker had been sitting on the shelf had nothing to do with it. I felt that, morally at least, the company had an obligation to make some kind of adjustment.

We both stuck to our guns for a while, and it looked like a stalemate, though I must emphasise that the discussion was quite amicable. Finally the rep relented, at least in part.

"I can't make this kind of decision myself," he explained. "All I can do is put it to someone higher up and make my own recommendation. I'll do the best I can."

That was on Friday afternoon. On Monday morning he was back in my shop with a large speaker box under his arm. It was the current version of the superseded speaker, and he requested that I pass it on to my customer with the company's compliments and apologies. There was no more talk about guarantee periods or authorised dealers, and it was obvious that the rep was as happy as anyone else that the matter had been settled.

And, to give the company their due, they must be complimented for standing behind their product, in spite of all the mistakes that were made along the marketing chain.

As for my customer, he was delighted. And well he might have been. The new speaker is a considerable improvement on the old one. It has a larger magnet which, among other things, gives improved damping and an increase in sensitivity of over 6dB. The latter was particularly valuable in view of the modest size of his amplifier.

So all ended happily. But my purpose in telling this story was not to publicly condemn the company for a fault which "shouldn't have happened," or even for their hesitation in replacing the speaker. After all, they wouldn't be the first company to produce a fault of this kind, and they certainly have the right to look at all aspects of a claim before they honour it.

My real purpose was to point out the pitfalls which await the inexperienced purchaser. My customer purchased that particular speaker, in good faith, simply because it seemed to be the kind of speaker he wanted at the price he could afford. I doubt very much whether he was aware that he was getting it at a reduced price, and he certainly had no idea that it was superseded, that it did not carry a normal guarantee, that he was not purchasing it from an authorised dealer, or even that there was such a distinction.

Thus when the crunch came, he was the innocent victim of circumstances. And while, in this case, the fault was so clear cut that there could be little argument about its origin, what about more subtle faults where there could be a doubt? Such a situation, combined with the irregularities of sale, could well leave the purchaser out in the cold, with no one willing to accept responsibility.

There is a legal phrase, in Latin, which means, "Let the buyer beware." Fair enough, as long as we know what to beware of!

To change the subject, I have reproduced a letter from a colleague in Auchenflower, Queensland, telling of the recent floods, their effect on electronic devices, and some of the attempts being made to salvage them.

While these might be regarded as luxury items, and represent only a small proportion of the personal items lost, one can nevertheless sense the heartbreak which the sight of a sodden, mud caked TV set must cause. The more fortunate among us might spare a thought for the victims next time we are tempted to winge at our own lot.

The recent flooding of Brisbane was very severe, and in many cases even the roof ridges were below water. Many Queensland houses are built on stumps, (which southerners call "stilts"), and those fortunate to be on high stumps in some areas had dry floors, while their neighbours had six or seven feet of water over their floors, because of their low construction.

Which brings up the fate of television receivers and other electronic equipment. A number of receivers have been examined and in all cases the speakers were useless. Also some types of valve socket had crumbled away.

The flood waters were extremely muddy and, in some houses, the silt left after the floods had receded was nearly a foot deep. Some of this was left in TV receivers. Mud was even found in the tuners, and doubtless there was mud in the coils.

The treatment of salvaged receivers was first to wash out the mud, endeavour to wipe off what remained, and then place in the sun to dry.

In some cases the outer layers of insulation had peeled from the power transformers and the smoothing inductance. Obviously the only safe cure for these would be their removal and heating in a vacuum oven. This could be a problem as the colour coding has suffered, and browns, blacks and reds tend to look alike. While identification by ohmmeter is possible, the removal, treatment, identification and reinstallation would certainly chew up man-hours.

Many of the yokes seem to be in almost perfect condition, and with treatment by silicone-aerasol spray should be good for many years. The EHT / line transformers appeared to be in good condition, particularly those which have good encapsulation. Vertical deflection components do not have the same protection, and would need oven treatment.

In almost every case the picture tube would have to be removed or the cabinet disassembled to clean the safety glass. Further work would be necessary to realign the IF stages, provided the ferrite cores do not disintegrate and/or are not jammed.

After treatment one model was observed to gradually slide down on its legs. Apparently the bottom of the cabinet had been of pressed wood or similar.

Several reports have been received of receivers that actually worked after a clean-out, and of others, that have worked for a short period before smoke was evident.

Certainly no serviceman would be foolish enough to give any guarantee on any restoration. The writer was asked what it would cost to restore an early STC model. When told that it might cost at least fifty dollars, the reply was that it had cost only forty dollars when they bought it.

Generally it appears that the only salvageable items would be the picture tube, the valves, knobs, EHT transformer, the yoke and the power plug. Against the value of these would be the man-hours spent in their recovery, all of which means that the residual value of such a receiver would be small. No doubt many servicemen may accept the challenge to reinstate some receivers, and will succeed, but what sort of guarantee they may give is doubtful.

Record and tape playing equipment, depending upon its initial value, will doubtless be restored by loving owners, and with probable success, provided new motors are obtained.

More modern solid state units — and amplifiers as well — will probably be easier to salvage because of the low voltages involved. However the printed boards need attention, as in some cases the copper has lifted. The use of "ICs" has simplified some models.

The main problem will be that of rust and, due to the long immersion, certain amounts of electrolytic action which has taken place between dissimilar metals.

Tapes have been saturated, and recovery is difficult. For instance, how do you clean and dry 1200 feet of tape? Records seem to have acquired a thin cover of greasy mud. Recovery is possible, but likely to be neglected because of more important problems.

The flood emphasised the need for better communications. In many cases people were without power and did not hear progress reports, or if they did, would just not accept the fact that their homes would be inundated . . .

At the "sending end" one radio station had its transmitter submerged and ABC TV studios had their basement partially submerged.

The only bright spot about the flood is that we were fortunate that it did not occur a week later when the "king tides" would have raised levels at different places between one and a half feet and possibly three feet. *J.W.*

And from a colleague in another flooded area, Coonamble, NSW, came this report.

"We were lucky in the recent floods, they just missed us. But a colleague in a lower part of the town was not so lucky. He lost virtually everything, including several TV sets belonging to customers.

"The rest of the servicemen in the district are getting together to see what they can do to help him."

A grim story in a few words. It does not take much imagination to visualise the loss of stock, business and service records, service manuals and data painstakingly collected over the years, to say nothing of valuable test equipment, probably bought piece by piece as he could afford it.

The only bright spot is the brief statement, "The rest . . . are getting together to see what they can do to help him."

Well, best of luck.

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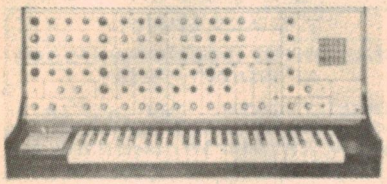

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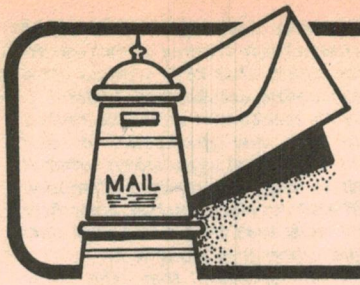

Letters to the editor

The views expressed by correspondents are their own and are not necessarily endorsed by the editorial staff of "Electronics Australia". The Editor reserves the right to select letters on the basis of their potential interest to readers and to abbreviate their contents where this appears to be appropriate.

Record Reviews

I would like to make reference to your excellent record reviews and would preface my remarks by saying that all my selections, on the basis of these reviews, have left very little to be desired.

As a member of the World Record Club, I am faced with the periodical problem of making a choice from their various programs. Without expert guidance, some records chosen may prove less than satisfying.

At this point, we run into a serious obstacle in that reviews of WRC records are published only after they have been obtained.

This means that when Mr Russell reviews a disc from WRC, it cannot be ordered by a member unless he has not yet lodged the program in which it appears.

If these records are to be reviewed, then some other arrangement should be made, such as allocating a special space for a brief run-down on all the records in a particular program shortly after it is issued to members.

J. M. Meyrick (Cheltenham, NSW).

COMMENT: We no longer review WRC releases because of the problems you have outlined. For us to be able to publish reviews more or less coincidental with the WRC release, they would have to supply us with pre-release copies several weeks ahead, which they almost certainly would not be able to do. The normal reviewing process for records and books alike assumes the usual retail stock and supply situation.

Transistor PA for 52MHz

In the January issue of Electronics Australia, you published a constructional article based on the 144MHz amplifier kit produced by my company. We were very flattered by your kind remarks about the performance of this 30 watt amplifier and the recommendation you gave to amateurs interested in the 2-metre band.

At the end of the article you posed me a question — will DSE follow up with companion kits for 6 metres and 432MHz.

The answer is yes! In fact, we had already approached Amateur Communications Advancements with a view to producing a version for 52MHz. The 6 metre version is very similar as far as the stage circuit is concerned. It is obviously necessary to wind different coils but a major advantage of using the 2N5591 at 53MHz is that it has far more gain — in fact the full 30 watt output can be obtained using only two stages and 100mW of drive (the stage using the 2N5590 is omitted). The component values need to be changed in the 2 watt stage and the coupling arrangements are slightly different.

In future the full kit and the various stages we offer will be supplied with details of both the 144MHz and 52MHz circuits and the lengths of wire included for the coils will suit both applications.

For the 52MHz circuit, incidentally, an MPF121 is ideal for producing the drive. Another point worth mentioning is the fact that we have had two reports of spurious emissions. The installation of 47 ohm 1 watt resistors between base and groundplane of each stage will soon cure the trouble at both frequencies.

I hope we will soon be able to provide amateurs with a circuit for 432MHz, but as you will readily appreciate, such a development isn't quite so straightforward.

R. H. Smith,
Managing Director, Dick Smith Electronics Pty Ltd,
Gore Hill, NSW.

Shortwave Scene

This is just a short note to say thank you for re-instating Arthur Cushen's column "Listening Around the World," under its new title "Shortwave Scene."

I have only one question — who is the bloke on the rack, on page 1 of the March issue?

All the best, and keep up the good work.

M. Little (Nhill, Victoria).

COMMENT: It's nice to get a letter like yours, after those unhappy letters about the column! As for the bloke on the rack, presumably it was meant to be the Editor — although some of the staff seem to think that the chap turning the handle was a better likeness.

Parts for AF Oscillator

Since publication in November last year of my article on an Audio Frequency Oscillator, I have had a number of letters seeking help in locating suppliers of precision fixed capacitors and ganged wire-wound potentiometers.

I have replied to all of the writers direct with the desired information. However, you may perhaps care to pass the information on in EA for the general information of readers who may need it for quite different projects.

Precision fixed capacitors of 1pc tolerance and 63 V Wkg rating should be available from:

J. H. McGrath & Co, 208 Little Lonsdale Street, Melbourne.

Should there be any difficulty here, such capacitors can be had quite quickly from England by Air Packet Post, without Customs difficulty and at reasonable prices. The 1uF size is supplied by:

Marco Trading Co, The Maltings, Station Road, WEM, Shropshire.

The latest quoted price is 60 pence, plus packing and postage.

Smaller sizes, also of 1pc tolerance, are supplied by:

A. Marshall & Sons Ltd, 42 Cricklewood Broadway, London, NW2 3 HD.

They have most standard preferred capacities up to 0.47 uF, sold as "Polystyrene Close Tolerance Capacitors." I have no up-to-date prices, but they are quite low.

Ganged pots (wire-wound) are made by A. G. Naunton of Brighton, Vic, and sold under the brand "AGN" through Radio Parts Ltd of 562 Spencer Street, Melbourne. They have to be obtained to special order and there is a charge for ganging the two individual units.

These pots can also be got from England on the above-mentioned basis, from such people as:

"Electrovalue," 28 St Judes Road, Englefield Green, Egham, Surrey.

These people supplied my own wants, but there was a little delay because, I gather, it was again a special order. It was a "COLVERN" component.

F. G. Canning (Portsea, Victoria).

COMMENT: Many thanks for the further information, Mr Canning. Readers should find it of particular interest and value in view of the widespread supply problems wih many electronic components.

Allen computer organ

As the Australian representatives for Allen Organ International Inc we read with interest your article in the February issue titled "The New Breed of Electronic Organs."

While we sincerely appreciate the coverage given in this article, there are two matters raised in it which we feel bound to comment upon.

The first is the question of volatility concerning the combination action memory. Although a MOS memory is in theory volatile, the combinations set up on the Allen computer organs are not lost when the console is switched off, and thus do not have to be reset each time the organ is used. This is because there is a "standby" power supply built into the organs, which supplies the MOS LSI memory ICs with the minute amount of power needed to retain the stored data, even when the console is switched off. The batteries only come into play in the event of a power failure.

The other matter is that of voicing. With a conventional pipe organ, as you are no doubt aware, the final voicing is done on site by the artisan, who is usually extremely gifted. Each pipe is voiced to suit and blend with the others, taking into account the acoustics of the environment to provide an integrated final result.

To perform the analogous operation with an electronic organ, one would presumably need individual filters for every note of every voice, or some two thousand filters of complex design for a 36 stop straight organ. Why, the electronic filters alone would probably fill a large room. This is something which, to my knowledge, is done in no electronic organ of conventional design produced commercially to date. In the full sense of the word, therefore, voicing as applied to pipe organs does not exist in electronic instruments.

Allen Organ Company stress that with their digital musically dedicated computer the harmonic structure is created with unprecedented accuracy and already correctly balanced in the first place. Thus allowances for certain acoustical characteristics can be taken care of by simple means such as speaker placement, additional presence speakers and simple amplifier controls. Allen are adamant that this was not possible with analog organs, and as they made their first commercial electronic organs back in 1939, they do have considerable experience and expertise.

We hope these comments may serve to set the record straight.

R. Mackay,
Mackay Electronic Distributors Pty Ltd,
(Doncaster East, Victoria).

Labgear colour generator

Referring to your review of the Labgear Colour Bar Generator in the new products section of the March issue, I would like to inform you that we have for the past few months been supplying these units with the vision carrier preset to 177MHz, which corresponds to channel 6. This appears to have completly obviated the herringbone interference pattern which was noted in your review.

If found necessary, the vision carrier is adjustable internally from channel 5 to channel 10 via a screwdriver slot control.

We trust that any misapprehension concerning the use of this instrument because of interference will now be eliminated.

P. Twigg,
Tecnico Electronics Division,
Pye Industries (D'ALES(Pty Ltd,
Marrickville, NSW.

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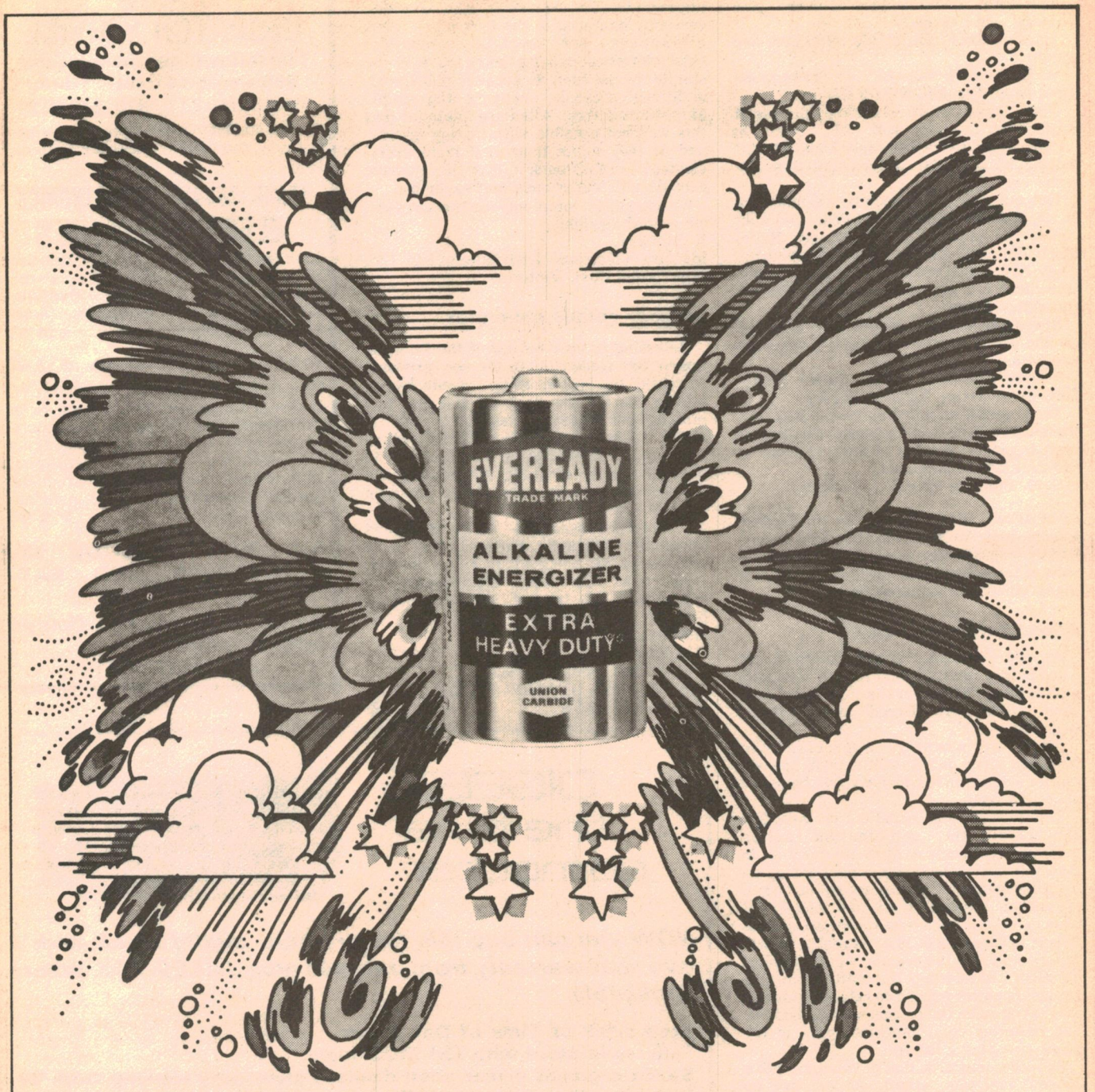

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085.P.199

Classical Recordings

Reviewed by Julian Russell

Mozart — unforgettable experience

MOZART — Symphony No 36 in C Major (K.425) "The Linz." Symphony No 38 in D Major (K.504) "The Prague." Berlin Philharmonic Orchestra conducted by Herbert von Karajan. EMI Stereo ASD2918.

Karajan starts the "Linz" with an impressive though never ponderous intro. Then the main body of the first movement goes at a steady pace but always with enough vitality to avoid any hint of plodding. The Berlin Philharmonic plays for him with all the expressive precision one has come to expect from this great orchestra. There is no trace of mincing either. Here is fine manly Mozart, firmly outlined, gracefully phrased and treated with the greatest respect. There is no flippancy or suggestions of rococo putti tumbling about the walls of pretty salons. The balance is always beyond praise.

Karajan's manifest affection for the lovely poco adagio makes of it one long tender song. You may find the menuetto a trifle solemn though to me it offers an effective contrast to the rest of the symphony in which the Finale is of outstanding brilliance, taken very fast, yet never obscuring vital details.

Again in the "Prague" you have a Finale of great but delicate energy to round off a performance that is almost flawless throughout. These are two of Mozart's most popular symphonies and I cannot think of any other coupling of them that I prefer. In my opinion they are likely to remain for a long time the best buy.The sound, too, is first class. Strong Mozart — yes. But without any hint of early Beethoven. And don't look for an atmosphere of crinolines and snuff boxes either. Instead, you stay in the music's unshakeable grip. An unforgettable experience.

* * *

CHOPIN — 24 Preludes, Opus 28. Prelude in C sharp minor, Op 15. Prelude in A flat major, Op Posth. Christoph Eschnenback (piano). DGG Stereo 2350231.

Of the many different recordings available of these Preludes, I think I had better select Rubinstein's as the best example of an entirely different approach from Eschenbach's. Rubinstein's brilliant aristocratic mono was first issued as far back as 1955 and so far as I know is still to be found, still in mono, by those who would like to make a comparison. He uses what might be described as a "delicacy through strength" touch. The result is a ravishing pearly sound in Rubinstein's case, imposed on to a solid framework of form. Eschenbach uses darker tonalities generally though he doesn't shun moments of dazzling scintillation. Moreover, while Rubinstein offers a string of gemlike individual pieces, Eschenbach presents the 24 Preludes with emphasis on the closeness of their relationships. The long pause after the first makes of it a sort of prelude in the old sense of the word. Pauses elsewhere seem to separate groups of the 23 Preludes that follow into movements of varying lengths.

I haven't the space to deal with each prelude but, to give you some idea of all, I shall note the first four as a kind of sample. In the first (by way of introduction) Eschenbach's grace and his beautifully judged rubatos prepare you for enjoyment to come. After the long pause mentioned above he embarks on the enigmatic No 2, emphasising its dissonant harmonies supporting a deeply meditative treble melody. No attempt is made at prettification but its sense of mystery is inescapable. No 3 has a beautifully articulated running accompaniment that sets off to perfection the always masculine grace of its melody. Although No 4 has been cursed by the popular name of "Tristesse" (yuk!) under Eschenbach's fingers it again becomes a thing of beauty.

The only word of recommendation I can make for Rubinstein's set against Eschenbach's is that if you want to be enchanted get the Rubinstein, which still wears wonderfully well despite its age. If you want to examine the Preludes in greater depth, then Eschenbach's is for you. I found his treatment a vast wonderland of hitherto unsuspected relationships. I should not be surprised if some readers find this type of playing a little too reminiscent of Schumann but to me this is a matter of no importance. By the way, for good measure, the Op 45 Prelude in C sharp minor and the posthumous Prelude in A Flat major are included. The sound is completely faithful.

* * *

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TCHAIKOVSKY — Waltz of the Flowers and Pas de Deux from The Nutcracker Ballet.
ENESCO — Roumanian Rhapsody No 1.
GERSHWIN — An American in Paris (with rehearsal sequence).
PROKOFIEFF — Alexander's Entry into Pskov from Alexander Nevsky. London Symphony Orchestra conducted by Previn. EMI Stereo SOELP 10034.

This might be described as a concert of Palm Court music, though no Palm Court band has ever played as well as this. Previn starts with the Waltz of the Flowers from Tchaikovsky's Nutcracker Ballet, notable in an all round excellent performance for the lilt in the accompanying strings imparted by an ever so slightly anticipated and extended second beat in the bar. Till now I thought only the Viennese could bring this off but here is a consistent example of complete success by an English orchestra. The London Symphony to a man seem to be doing it instinctively though it is a trick that takes many hours of practice to achieve. In the Pas de Deux from the same ballet, with its descending minor scale passage as its main theme, Previn wins from his band embracing warmth ornamented with exquisite whispers from the woodwind and harp. It is wonderful playing and makes one marvel again just what Tchaikovsky could do with such simple material. It is no exaggeration to describe him as one of the world's very greatest melodists.

In Enesco's Roumanian Rhapsody Previn keeps the rhythms dancing, no matter how often the tempos and time signatures change. It is an exhibition of superb but non-showy virtuosity, in turn tender and fiery. Even the most blase of listeners might well be thrilled by the sheer exuberance of the playing and the exciting quality of the recording. If you are looking for something to charm you out of a fit of the blues, this is it. Everything's as fresh as a smogless Spring morning.

Then comes an interlude in which you hear Previn rehearsing the orchestra in Gershwin's American in Paris. Born in Germany despite his French-sounding name, Previn uses perfect American-accented English. The interlude is not very long but it serves to illustrate Previn's style of discipline and instruction. In this piece, great orchestra though it is, the London Symphony seems to lack the idiomatic ease of a good American group. The players seem to me to be trying just a tiny bit too hard though you may think that I'm quibbling.

The concluding item is Alexander's Entry into Pskov from Prokofieff's Alexander Nevsky. In this the orchestra is joined by the London Symphony Chorus in what is a conventional triumph scene with typical spiky Prokofieff interjections—at a guess included for ballet purposes. The sound throughout the whole disc is immensely satisfying.

* * *

GREAT TENORS OF TODAY — Operatic excerpts sung by Franco Corelli, Luciano Pavarotti, Nicolai Gedda, Placido Domingo, Carlo Bergonzi, James King, James McCracken and Jon Vickers. EMI Stereo OASD7577.

As might have been expected from the title, here they all are with their operatic excerpts shared between French and Italian composers. There is one exception, that fine American Wagnerian tenor, James King, who sings Am Stillen Herd, Walter's rhapsodic outburst in Act 1 of The Mastersingers. Except for him all have their likenesses and differences.

Are any readers of this column old enough to remember the radio show, I think it was on 2GB in the 1930s before the days of TV, in which listeners were invited to identify which tenor had sung an item they had just heard. To do so successfully was not as easy as one might think. There were, of course, tenors with strong personal idiosyncracies but these were in a minority. Most of the others had tiny mannerisms immediately

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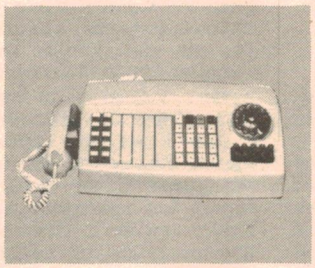

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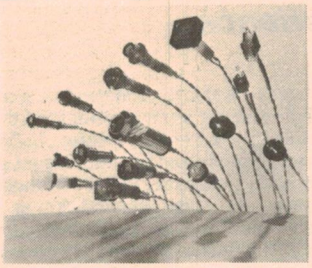

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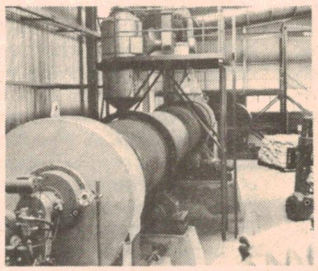

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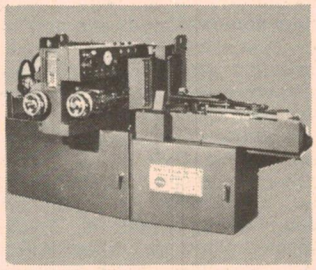

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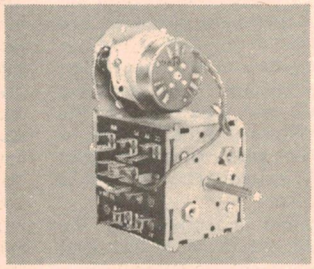

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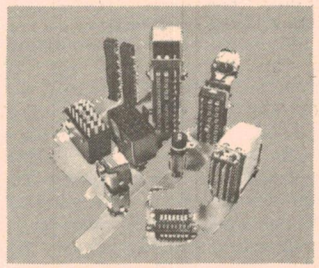

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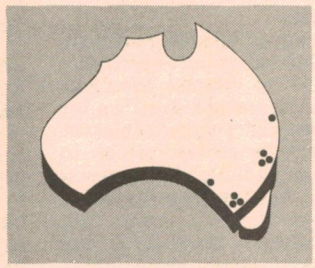

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recognisable by those who owned their discs but not strong enough to tip off others.

You can have similar fun with this well-produced record by challenging friends to pick just who is singing what.

You will find some interesting facts in the potted biographies of the — I nearly wrote competitors — contributors in the sleeve notes. Who would have guessed, for instance, that a singer with as Italian-sounding a name as Nicolai Gedda was of Swedish-Russian parentage?

Those partaking are mentioned above. The items they sing are as follows: Corelli — Celeste Aida; Pavarotti — O, Amore (L'Amico Fritz); Gedda — Salut, Demeure (Gounod's Faust); Domingo — Donna non vidi mai (Manon Lescaut); Bergonzi — Oh, tu che in seno agli angeli (Verdi's force of Destiny); Gedda — Flower Song (Carmen); King (Am Stillen Herd); Corelli — Come un beldi di maggio (Giordanos Andre Chenier); McCracken — Niun mi tema (Verdi's Otello); Bergonzi and Taddeo (bass) — Recondita armonia (Puccini's Tosca); Vickers — Arretez, o mes freres (Saint-Saens' Samson and Dalila).

As you can see it is not possible to review each item in a magazine of this type. Besides, your preferences will, of necessity, be personal ones unlikely to be affected by anything I write. So I shall leave them all with the comment that the disc is generally speaking excellently performed and produced and should have a wide appeal to those interested in this sort of thing.

* * *

SIBELIUS — Symphony No 7. Tapiola. The Oceanides. Bournemouth Symphony Orchestra conducted by Paavo Berglund. EMI Stereo ASD2874.

That the Bournemouth Symphony Orchestra is in fine form is evidenced in the very first few bars of the 7th Symphony. But before going on to analysing the performance, readers may be interested in some of the facts set out in the sleeve notes. These are by the conductor Paavo Berglund who "prepared the work for performance." This is another way of saying that he edited it and, he claims, that while doing so he found "many discrepancies between the orchestral parts and the published score." Now I find it surprising that the composer himself, who survived the symphony by some quarter of a century, didn't attend to the corrections himself. It can be assumed that the alterations in the orchestral parts were made by Sibelius himself during rehearsal, a not uncommon practice of the composer. And one might guess with confidence that the corrections were written in on the spot by the musicians making the necessary changes in their parts.

Making small alterations in the score of their works during rehearsal has been common among many recent composers, the most inveterate and important to do so being Richard Strauss and Vaughan-Williams. Strauss is alleged to have pencilled one into the score while conducting the first performance of his Woman Without a Shadow, shifting his baton from his right to his left hand to enable him to do so. Berglund goes on to write: "On referring to the original I discovered approximately 400 errors in the printed score and parts . . ." And he says further that the score is being reprinted in accordance with revisions he made and which he uses in the performance under review. Many of these alterations are very minor indeed, comprising for the most part changes in the dynamics of different passages.

Now to the performance, Barglund's reading is sternly Sibelian. His orchestra scales craggy heights, surveys the majestic scene around it — the usual strangely unpeopled Sibelian landscape — and descends to attack the brisk complexities of the scherzo with impressive unanimity. An unusually reverberate acoustic glosses over some of the starkness of the orchestration, otherwise the sound is never less than grandly spacious.

In The Oceanides, Berglund takes a rather more romantic view of the piece than most other conductors who have recorded it. Indeed he makes it sound quite juicy in parts. Whether you like this treatment will be entirely up to you personally. But, whatever your preference, you won't be disappointed in the final climax which is really shattering. The reverberant acoustic mentioned above removes some of the "pointilist" effect described by my old friend, the late Cecil Gray, back in the middle 1930s.

But this is not so in the other tone poem on the disc, the great Tapiola, which is recorded with magnificent clarity. The only quibble I have to make is that I would have liked a longer interval between the end of The Oceanides and the beginning of Tapiola, which sounds almost like an appendage to the first named. Tapiola, that miracle of monothematic development, has some truly frightening climaxes. If you are sufficiently interested, compare what looks so simple in the score with the overwhelming sound produced. On the whole, this is a disc that I can heartily recommend whether you are a newcomer to Sibelius or an old admirer, like myself. It offers a splendid cross section of his later work, although newcomers to this composer must be reminded that during the last 25 years of his life Sibelius inexplicably wrote no music at all. An 8th symphony, constantly hinted at, was never found after his death, nor any explanation of his final idleness.

BRITTEN — A ceremony of Carols. Missa Brevis. Hymn to St Cecilia. King's College Choir, Cambridge. David Willcocks, director, Osian Ellis, harp and Ian Hare, organ. EMI Stereo 1285.

The Ceremony of Carols opens with the angelic cooing of the boys of the King's College Choir in the introductory Processional. Those who know the choir will recognise this sound as characteristic. It is charmingly innocent but nonetheless precise. And this precision is maintained even during sudden changes of key and against polytonal passages on the harp. The pitch never wavers. The carols are Wolcum Yole, There is no Rose, That Yonge Child, Balulalow, As Dew in Aprille, In Freezing Winter's Night, the Spring Carol and Deo Gracias. The ceremony fades away most effectively as the choir leaves the chapel. I mentioned earlier the characteristic cooing of the choir. I must, however, hasten to add that they can give voice quite exultantly when called upon to do so by their fine director, David Willcocks. Ossian Ellis' Crystalline harp contributions blend exquisitely with the singers. He makes his instrument sound just about as expressive as possible.

I think the Ceremony of Carols comes off a trifle better than the Missa Brevis though here again may be a matter of my personal preference. But should this make you hesitate in favour of another version I urge you to take into consideration the inclusion of the beautiful Hymn to St Cecilia for mixed choir. In this the tenors and basses not only blend beautifully with the boys' voices but also add the extra touch that advertises not only the natural singing talents of all concerned but also the solid musicianship on which everything is founded. Unless you positively dislike this very English style of choral singing — and it must be admitted that to some it is anathema — you will find this a bewitching disc.

A mystery — of the very highest order!

MOZART — String Quintet in D Major (K. 593). String Quintet in E Flat Major (K.614). Amadeus Quartet with Cecil Aronowitz as second viola. DGG Stereo 139433.

This disc has a strange history, or at least appears to have one. A recording of these two quintets played by the same musicians existed as far back at 1957, when it was deleted from EMI's catalogue. At that time it was available only in mono form. Some time later — in 1958 — it appeared under the DGG label, this time in stereo, taken from the tapes that had produced HMV's mono version. Then in 1962 the D Major, played by the Amadeus, again appeared under the DGG label but this time it was coupled with the Mozart G Minor (K.516). Whatever the history of this disc, no one would ever guess its early origin from the sound of the present issue. Was it made from the old tapes? The sound is so good that this is difficult to believe. Yet is must be remembered that the sound of chamber music was already very good indeed way back in the early days of stereo — and even mono.

However the sound is as fresh and true as in the best of modern recordings. My only cavil is the intrusion — slight though it may be — of the cellist's fingers occasionally striking his instrument's fingerboard. The playing has all the virtues one always expects from this great ensemble. Its unanimity of purpose is such that the 10 hands employed in its performance might have been directed by the one brain. It is unnecessary to point out that the Amadeus has a faultless sense of Mozartian style. Their tone is of continuing beauty. The surface of my pressing is slightly prickly but that might just be my bad luck. I have received complaints of unsatisfactory surfaces from readers and on checking with my own pressing have found mine to be quite without extraneous noises.

By the way, I have just learned that, to add to the mystery of this issue, the Amadeus recorded the G Minor as early as 1953. And to complicate matters still further, the sleeve of the present issue under review was copyrighted by Polydor International only last year.

But, as I wrote above, the sound on the recent issue is first rate and the playing of the very highest order.

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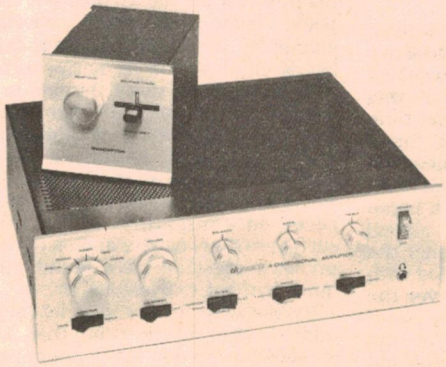

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Reviews of other recordings

Devotional Records

PAT BOONE SINGS GOLDEN HYMNS. Stereo, Lamb & Lion LL-1001 (from Sacred Productions Aust, 181 Clarence St, Sydney, and other capitals).

"Lamb & Lion" is a relatively new American label associated with Pat Boone Productions, and featuring Pat Boone. While the pictures on other jackets in the series show Pat Boone in a "with it" hair cut in a youth setting, this particular disc features traditional hymns, in traditional mood, with only minor concessions to the modern approach.

The hymns: Precious Lord, Take My Hand — In The Garden — Will The Circle Be Unbroken? — Sweet Hour Of Prayer — Pass Me Not — Amazing Grace — What A Friend — Nearer My God To Thee — My God Is Real — The Old Rugged Cross.

Much less bland than his early "short back and sides" recordings, this release retains their excellent diction, and should appeal to a somewhat wider audience. The quality is excellent. (W.N.W.)

★ ★ ★

THE NEW SONGS OF THE JESUS PEOPLE. Pat Boone Sings. Stereo, Lamb & Lion LL-1002. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals).

In this album, Pat Boone identifies with the "Jesus people." They were "drop-outs, freaks, druggies . . ." runs the jacket note but the "Jesus People" depicted on the front look like a typical group of "non-freak" young people enjoying a musical rally. For the most part, the songs are "new," but surprisingly, the sound ranges only from gentle rhythm to very soft rock.

Here are the titles: One Way — Little Country Church — Hallelujah — Children Of The Day — Take A Little Time — I Have Decided To Follow Jesus — Hymn — Walking Hand In Hand — Forgive Me My Friend — For Those Tears I Died — Be Attitudes — I Wish We'd All Been Ready.

Diction is good, quality is good and this should be a good one for family Gospel listening — modern enough to have a youth appeal but quite pleasant for mature ears. Well worth a hearing. (W.N.W.)

★ ★ ★

SINGING JOYFULLY. The Fuller Seminary Student Body Chapel Choir. Stereo, Light LS-5616-LP. (From Sacred Productions Australia, 181 Clarence St, Sydney and other capitals).

This album will have a special appeal to those who like good traditional 4-part singing of traditional hymns. It is a mixed student group but the male voices dominate to the extent that it sounds more like an all-male choir. With arrangements by Ralph Carmichael and conducted by David Hubbard, colour comes mainly from the piano accompaniment and nicely executed key changes.

The titles: Praise To The Lord, The Almighty — Oh For A Thousand Tongues — Jesus Lover Of My Soul — Jesus Shall Reign — Pass It On — All Hail, The Power — Our God Our Help In Ages Past — When I Survey — Amazing Grace — He's Everything to Me.

The twelve tracks play for just over 24 minutes but it is 24 minutes of excellent traditional sound from young people who sing with conviction. The technical quality of the imported pressing is excellent. (W.N.W.)

Instrumental, Vocal and Humour

BIG BAND HITS OF THE 20s, 30s and 40s. Enoch Light and the Light Brigade. Total Sound L-45341 / 2 Stereo Festival.

If you're like me, a softy for the big band hits of past years, don't miss this two-record album at the steal price of $7.95. Some of the tracks, like "Cherokee," "Woodchoppers' Ball," "South Rampart St Parade," "One O'clock Jump," "Let's Dance" and "Tuxedo Junction" are the best sound recreation of the era one could wish for, with impeccable sound quality and stereo spread.

Some of the other titles are: Marie — Somebody Loves Me — Jersey Bounce — Tea for Two — Take the "A" Train — I can't Get Started — If You Knew Susie — Begin the Beguine — Flying Home — Sometimes I'm Happy. The older titles have the "Woop de Doo" sound of the Roaring Twenties. In all, an album I thoroughly enjoyed. (N.J.M.)

★ ★ ★

FERRANTE & TEICHER Salute the Hollywood Musicals. Stereo, United Artists, Festival L-35002.

Duo-pianists Ferrante & Teicher are backed here by the Nick Perito orchestra, but I would not have been the least surprised to find the name "101 Strings" on the label. It's that kind of sound and why shouldn't it be, with an array of show tunes as here presented: Tonight — Sound Of Music — Hello Dolly — Younger Than Springtime — I Could Have Danced All Night — People — Chim Chim Cheree — I Wish I Were In Love Again — The More I See You — Love Is Here To Stay — You Do Something To Me — I'm In The Mood For Love — Begin The Beguine — Blue Skies.

It's pleasant music — and lots of it — but I'd sound a word of caution if you plan to play it on a full range system. Here and there there's a vague edge to the sound that might prompt you to turn the treble down a trifle. Which probably means that it would sound quite normal on a medium-fi system. (W.N.W.)

★ ★ ★

MISSISSIPPI BANJO BAND. Paramount stereo L25051.

Now I like banjo bands so I was keen to listen to this album. But I found I could not listen and enjoy it because the instrumental was too complicated. It was like an old New Orleans jazz band trying to play three different tunes at once. The result is irritating chaos. Still, if you're really keen, have a listen. Sound quality is okay.

Twenty-four tunes are presented altogether, some in medley form: River Song (theme from "Tom Sawyer") — A Man's Gotta Be — Free Bootin' — On The Mississippi — Way Down Yonder In New Orleans — Down By The Riverside — Sentimental Journey — Gratification. (L.D.S.)

★ ★ ★

GRYPHON. English Medieval Pop. Transatlantic stereo L-34991.

Gryphon is an English pop group with a medieval flavour. They play a batch of traditional tunes using instruments such as recorders, mandolins, guitars, bassoon and crumhorns. It has to be heard to be believed. I'm all for them as they are a refreshing change from high-powered cacophony foistered onto a gullible audience by the majority of today's mercenary rock groups.

Still, all is not roses. While some of Gryphon's music is delightfully pleasant, some of it is idiotic buffoonery. Or is that supposed to be part of the medieval touch? Have a listen to a few tracks and see for yourself. Record quality is very good.

The tracks line up as follows: Kemps Jig — Sir Gavin Grimbold — Touch And Go — Three Jolly Butchers — Pastime With Good Company — The Unquiet Grave — Estampie — Crossing The Stiles — The Astrologer — Tea Wrecks — Juniper Suite The Devil And The Farmer's Wife. (L.D.S.)

★ ★ ★

SOME OF MY FAVOURITE THINGS. Acker Bilk, his clarinet and strings. Astor quad 1022.

This album from Acker Bilk was a little disappointing. The arrangements seem just a little too slow and drawn out. And Acker sometimes sings where he should stick to his clarinet. At least I think its Acker. Quality is good and stereo spread is smooth and wide. I did not listen on a four channel set-up.

Fourteen tracks are presented in all: Stranger On The Shore — Claire — What Are You Doing The Rest Of Your Life — The Folks Who Live On The Hills — Makin' Whoopee — Misty — Close To You — The Summer Knows — Raindrops Keep Falling On My Head — This Guy's In Love With You — Sugar — What A Wonderful World — A Hundred Years From Today — Going Home. (L.D.S.)

Reviews in this section are by Neville Williams (W.N.W.), Harry Tyrer (H.A.T.), Leo Simpson (L.D.S.), Gil Wahlquist (G.W.), and Norman Marks (N.J.M.).

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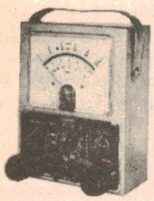

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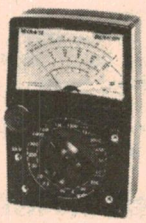

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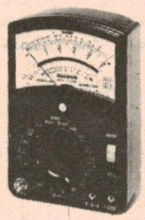

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GOLDEN HITS OF THE 60's. The Brass Ring. Probe stereo SPSS 10074.

The Brass Ring is a really polished band with a style akin to a cross between the bands of Enoch Light and Percy Faith. Very pleasant and easy on the ear. Sound quality is very good. Highly recommended at the price of $2.99.

Tracks presented are: The Shadow Of Your Smile — Moon River — The Girl From Ipanema — Theme from "A Summer Place" — I Will Wait For You — Al Di La — A Man And A Woman — Lara's Theme — Do You Know The Way to San Jose — Up, Up And Away — The Look Of Love — Georgy Girl. (L.D.S.)

★ ★ ★

THE LARRY PAGE ORCHESTRA. Harlequin Series L 25032. Stereo, Festival release.

For a suggested retail price of $3.99, this record gives you a high quality performance of a dozen recent hits, with such titles as: Wichita Lineman — Light My Fire — I Say a Little Prayer — Those Were the Days — Scarboro' Fair — Dream a Little Dream of Me — Hey Jude — Little Green Apples.

The only sour note is a trace of distortion on the "Hey Jude" track. If the titles appeal, I think you will like the disc. (N.J.M.)

★ ★ ★

BAKER'S DOZEN. Ken Baker at the Philicorda Organ. Stereo, Interfusion (Festival) L-35005.

In an era when it is common practice to make an electronic organ sound like something else, it is almost a novelty to hear an instrument voiced and played to bare its electronic soul. Not that it sounds bland on that account: Ken Ball is far too facile at the keyboard to let that happen, and he's backed for good measure by Pete Morgan on bass and Chris Karan at the drums.

The treatment and the jacket notes are highly tongue-in-cheek but despite all the throw-away lines, Ken Baker does explain what he's up to and the registrations which he uses throughout each track. And the tracks are:

When I'm over 64 — Bridge Over Troubled Water — I'll Never Fall In Love Again — Speak Softly, Love — Philinova — Beethoven 5 — Norwegian Wood — Amazing Grace — Humoresque — Spanish Harlem — I'd Like To Teach The World To Sing — Guantanamera — Number 13.

Broadly, it's like an early model Hammond heavily "souped up" and, if you like that kind of sound, you'll enjoy having bought Kenny Baker's Dozen. (W.N.W.)

★ ★ ★

THE INCREDIBLE PACO PENA. Stereo, Fontana (Phonogram) 6870-508.

I'll go along with the description "incredible," not because Paco Pena is unique, but because he possesses the kind of dexterity which I find incredible in a number of leading Flamenco guitarists.

There are nine generous tracks on the album, the names of which may or may not mean something to you: Soleares — Alegrias — Tarantas — Tientos — Bulerias — Cantinas — Granadinas — Fandangos — Zapateado.

While Paco Pena's technique is all that I've implied, not everyone wants to listen to that much Flamenco at one sitting. But, whether you listen to one track or several, you'll be impressed by the recording quality. The sound is hard and incisive, unmarred by any trace of noise or distortion. At $2.75 it's a bargain, if you're a Flamenco fan. (W.N.W.)

★ ★ ★

BOOTS RANDOLPH, SENTIMENTAL JOURNEY. Monument Records L34967. Stereo. Festival release.

Big band sound, a good balance between solo saxophonist and orchestra and a representative selection of evergreen hits of the forties, make for very pleasant listening.

Some of the titles are: Marie — Stormy Weather — Deep Purple — Sentimental Journey — Sweet Georgia Brown — So Rare — Lazy River — Star Dust. The sound quality is excellent and the almost strict tempo would make a good dance record for those who still rememger how, before dancing became the solo affair it seems to be today. (N.J.M.)

★ ★ ★

THE BEST OF THE MILLS BROTHERS. Paramount stereo L45371/2. 2-record set $7.95.

The Mills Brothers have been renowned for almost 50 years for their smooth harmony. Most people are under the impression that the Mills Bros they hear today are the same as the original group but this is not the case — some of the personnel have changed. To my ear, their presentation is not as smooth and as mellow as it once was. To most people however, this is probably a quibble and they will enjoy the songs presented just the same.

One of the Mills Brothers' recent successes, "Cab Driver" is featured on the two-disc set. Record quality is good and surface noise is negligible.

Some of the other tracks on the set are: Yellow Bird — Hey There — Lazy River — I'll Be Around — Standing On The Corner — Paper Doll — Moon River — Till Then — My Shy violet. (L.D.S.)

★ ★ ★

THE GUITAR SOUNDS OF BUDDY MERRILL. Calendar stereo L 15261. Festival release.

Although the sound tends to be two channel instead of stereo, the overall quality and effect of this record is very pleasing. At the budget price of $2.59, you get a fourteen title selection of old and new hits, including: Hava Nagila — Fascinating Rhythm — Love Makes the World Go Round — Caravan — Poinciana — Busy Bee — Malaguena — La Paloma. A good record for a quiet evening's relaxing after a hard day in the salt mine! (N.J.M.)

★ ★ ★

THE NEW GOLDEN HITS OF THE PLATTERS. Interfusion Stereo SITFL 934580 Festival Release.

The Platters are a well disciplined vocal group that have been around for some time and this release of old and new hits demonstrates their skill with a lyric. The titles are: I Love You a Thousand Times — With This Ring — Washed Ashore — The Great Pretender — My Prayer — Only You — The Magic Touch — Harbour Lights — Smoke Gets In Your Eyes — I'm Sorry — Twilight Time — Heaven on Earth.

The treatment is swinging rather than rocking and quality is good. (N.J.M.)

★ ★ ★

THE ANDREWS SISTERS. Paramount Harlequin series L-25082 Festival release.

My age is showing: I can remember the first names of the Andrews Sisters. Perhaps its no wonder because, in their heyday, you could find their latest hit playing somewhere on the radio dial almost any

For your quadraphonic collection

FUTURE SOUND SHOCK. Enoch Light and the Light Brigade. Quadraphonic, Project 3 (Festival) PJL-34944Q.

Not inhibited by false modesty, Enoch Light says that his team has "produced THE recording of the future, which will serve as a leader in the world of recorded sound for many years to come." What's more, having listened to the record, one might be inclined to believe those brave words.

The sound is absolutely clean and it really exploits the 4-channel medium — this without the help of complex logic systems. My guess is that it is going to be one of the war horses of quadraphonic demonstration systems for some time to come.

The sound is typical Enoch Light material, uninhibited arrangements, plenty of percussion and very well executed. The tracks: St Thomas! Everybody — Cute — Recado Bossa Nova — Caravan — Pick Yourself Up — Perdido — Samba de Orfeu — Give Joy To The World — One Note Samba — Baubles, Bangles and Beads — The Girl From Ipanema.

Perhaps I should add that the sound isn't anything like as way out or as noisy as the title might imply and the album is likely to be a fine piece of software for your new quadraphonic system; unless, of course, you have an aversion to the Light: Enoch Light! (W.N.W.)

★ ★ ★

BEIN' GREEN. Urbie Green, trombone. Quadraphonic, Project 3 (Festival) PJL-34812.

Whereas some albums are notable for their exploitation of the 4-channel facility, this one will be remembered mainly for the outstanding talent of American trombonist Urbie Green. Not that there is anything wrong with the quadraphonic sound — it's clean and well dispersed. It's just that you'll find yourself listening to the artist and the program rather than the medium.

Using over-recording to play as many as four parts, Urbie Green heads up a modest combo to present a variety of mainly up-tempo numbers which both display and challenge his versatility: I Got Love — Bess, You Is My Woman — Uncle Albert/Admiral Halsey — Pathetique Sonata — Bein' Green — Brand New Key — Nobody's Fool — Quadrabones — The Weenies — Ave Maria.

Ave Maria? It's played straight, with harpsichord-like accompaniment and a touch of organ, just to show that he can do that, too. An unusual album and worth a hearing. (W.N.W.)

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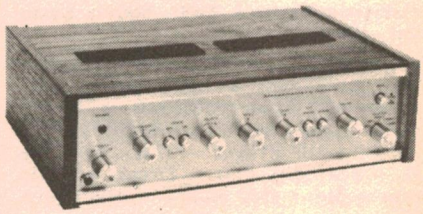

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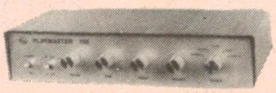
As featured in Dec 72 issue of Electronics Australia



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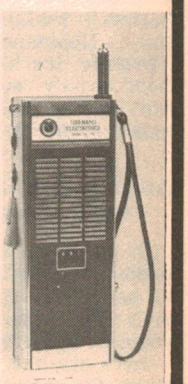

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time of the day. They had a mixture of Boogie and Latin rhythms that was all their own and this record would be most typical of their style with fifteen titles including: Boogie Woogie Bugle Boy — Rum and Coca Cola — Beat Me Daddy, Eight to the Bar — In the Mood — Rhumboogie — Don't Sit Under the Apple Tree — Pennsylvania Polka — Bei Mir Bist Du Schon.

The quality is quite good; buy it and show your teenagers what turned you on in the good old days! (N.J.M.)

★ ★ ★

REMEMBER SHIRLEY. 20th Century Records L-45311 / 2 Festival.

I should have known better when the Editor-in-Chief rang and said "you're interested in this nostalgia record boom that's on at the moment, aren't you?" Innocently I replied "yes" and what do I find amongst the records? A two-record album of sound tracks from Shirley Temple movies from 1934 to 1940 — twenty-seven songs, all in pseudo-stereo. If you can remember back that far, they might revive a few memories of an age of relative innocence in movie entertainment. The quality betrays the age of the originals.

Incidentally, I hope you're not as out of touch as one relatively young acquaintance whose remark was "Shirley Who?" (N.J.M.)

★ ★ ★

DON LANE. With Orchestra and Chorus Stereo, Festival L-34989.

If you like listening to Don Lane on TV variety shows, you'll probably like this album well enough; it's average Don Lane sound. On the other hand, I doubt that it will win him new followers. He doesn't sound all that interested and the effect is heightened by a recording that itself is lacking in reverberation; a clean sound but very "dry."

The titles: Sing — And I Love You So — Good Time Charley's Got The Blues — Tie A Yellow Ribbon — Ain't No Sunshine — Clair — Keep On Singing — Flim Flam Man — Song Sung Blue — Daisy A Day — Help Me Make It Through The Night — ASong For You.

Routine, but okay if you like the artist and the songs. (W.N.W.)

★ ★ ★

SEPTEMBER SONG AND OTHER FAVOURITES. Artie Shaw and his orchestra. RCA Camden stereo CAS 908.

The tracks on this album have been remastered (electronically enhanced) in stereo from 78 rpm masters to give quite a passable sound. Tunes recorded by Artie Shaw's three bands are featured. Sound quality is good for the era. And it makes pleasant listening.

Ten tracks are featured. The year they were originally recorded is bracketed: September Song (1945) — My Blue Heaven (1940) — Snug As A Bug In A Rug (1939) — Georgia On My Mind (1941) — Easy To Love (1945) — Rose Room (1939) — You're A Sweet Little Headache (1938) — They Can't Take That Away From Me (1945) — When Winter Comes (1939) — Shadows (1939). (L.D.S.)

Historical album from HMV

GREAT BRITISH SOPRANOS. The HMV Treasury. HMV mono HLM 7033.

Of great historical interest this album, with some tracks recorded as far back as 1904. And it shows well the style and skill of sopranos that would otherwise be forgotten. I obtained a lot of pleasure listening to it. All the material comes from 78 rmp disc masters but the quality on some tracks is surprisingly good. I suppose I should no longer be surprised, in fact, because the signal put on to some of these old discs was very good — nobody ever heard it, that's all!

But somebody must have slipped up when they produced the sleeve, because they refer to the ten photographs of the sopranos on the front but all it depicts is a rural landscape at dusk.

The list of sopranos and the songs they sing is as follows: Agnes Nicholls, "Ocean, thou mighty monster" from Weber's "Oberon" (1911); Miriam Licette, "Misera Elvira . . ." from Mozart's "Don Giovanni" (1929); Joan Cross, "Willow Song" and "Ave Maria" from Verdi's "Otello" (1937); Eva Turner, "One fine day" from Puccini's "Madame Butterfly" (1933); Mary Garden, "Mes Longs cheveux" from Debussy's "Pelleas et Melisande" with Piano Accompaniment by Claude Debussy (before 1904); Maggie Teyte, "Psyche" by Paladilhe (1941) and "Ce n'etait pas la meme chose" by Hahn (1946); Isobel Baillie, "Ne' trionfa Allessandro" from Handel's "Allessandro" (1949); Elsie Suddaby, "O sleep! Why dost thou leave me?" from Handel's "Semelle" (1924) and "Hark! The echoing air" from Purcell's "The Fairy Queen" (1924); Doris Labbette, 3 songs by Delius (1929); Gwen Catley, Variations on a nursery theme by Adam (1949). (L.D.S.)

ESPANA ELECTRODINAMIC. Waldo de los Rios and his orchestra. Hispavox stereo L 34979. Manufactured and distributed by Festival Records Pty Ltd.

"Magic sounds" these may be but it was all lost on me. The arrangements are certainly lively but they lack lustre. Sound quality is also not as clean as it could be. So if you want to buy it, have a listen first.

Twelve tracks are featured: Islas Canarias — Adios Granada — Flamenco — Ojos Verdes — El Porompompero — Maria Dolores — Los Cuatro Muleros — El Relicario Coplas Del Luis Candelas — La Luna Y El Toro — Doce Cascabeles — La Virgen De La Macarena. (L.D.S.)

★ ★ ★

THE BEST OF LITTLE RICHARD, Scepter Citation CTN-18020. Astor Release.

I'm sorry, but early Rock and Roll material like this was never my cup of tea, so I can only report on the contents and the quality, which is only fair.

The titles: Good Golly Miss Molly — The Girl Can't Help It — Keep a Knocking — Lucille — Long Tall Sally — Baby Face — Rip It Up — Tutti Frutti — She's Got It — Slippin' and Slidin'. If you like the titles, best of luck. The total playing time is only 23½ minutes so, when you compare it with the Golden Hour series from the same company, it does not present very good value. (N.J.M.)

★ ★ ★

CHARLIE RICH. LONELY WEEKENDS. SUN Record L 3459 Festival Release.

If you like your songs a bit on the sad side, this record could be your dish. With a skilled backing group and wordless chorus Charlie Rich sings his way through eleven titles, including: Lonely Weekends — Unchained Melody — C.C. Rider — That's How Much I Love You — Big Man — Break-up — Sittin' and Thinkin'. The quality leaves no room for complaint. (N.J.M.)

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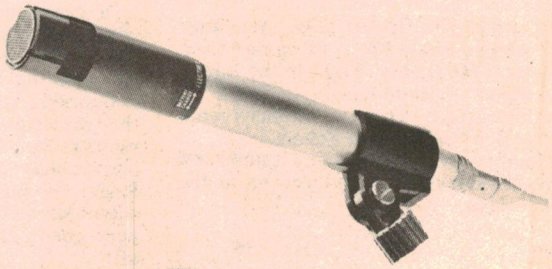

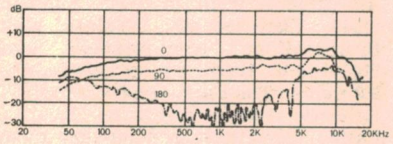

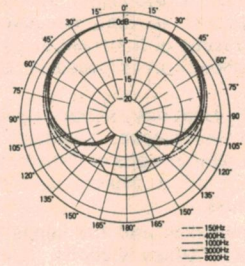

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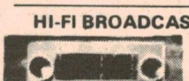

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Remember Glenn Miller?

Glenn Miller (far left) disappeared while on a flight over the English Channel in late 1944. His band was one of the most popular of the day, and during the war entertained troops in all areas.

REMEMBER GLENN. Glenn Miller and his orchestra. 20th Century stereo L 45315 / 6. 2-record set $7.95.

These renditions by Glenn Miller's band of many well-known tunes are not the versions that many people will be familiar with — they are versions culled from soundtracks of films in which the Miller orchestra performed. So it's Miller music with a difference. But whether you'll like the difference is not guaranteed. Some tracks have the typical mixed chorus, so popular in those days, but which turns me right off. So have a listen before you buy. Quality of the recording is passable, considering the source of the material.

In all, there are eighteen tracks: In The Mood — Boom Shot — Serenade In Blue — Bugle Call Rag — Chattanooga Choo Choo — You Say The Sweetest Things Baby — It Happened In Sun Valley — Measure For Measure — Moonlight Sonata — I've Got A Gal In Kalamazoo — At Last — Sun Valley Jump — That's Sabotage — American Patrol — The Spirit Is Willing — People Like You And Me — I Know Why And So Do You — Moonlight Serenade. (L.D.S.)

MY SECOND ALBUM. Donna Fargo. Stereo, Dot (Festival) ZL-34847.

Ranging from gentle rhythm to soft rock, this handsome double fold album has the sound of Nashville from the opening bars. And, sure enough, the jacket notes say: "Recorded at Jack Clement Studios, Nashville, Tennesse.

Easy on the eye and easy on the ear, Donna Fargo is backed mainly by guitars and organ to sing: A Song I Can Sing — You Don't Mess Around With Jim — Don't Be Angry — Have Yourself A Time — You Were Always There — Superman — How Would I? — I'd Love You To Want Me — He Can Have All He Wants — Forever Is As Far As I Could Go — Hot Diggity Dig.

The recording quality is excellent and if you are in any way partial to Donna and her songs, you'll enjoy listening to her "Second Album". (W.N.W.)

* * *

HALF BREED. Cher Bono. MCA stereo MAPS 7068.

Cher Bono belts out the good stuff here and her recent hit "Half Breed" is the feature track of the album. Sound quality is good and Cher fans will be breaking their necks to get what is probably one of her best albums to date.

Track titles are: My Love — Two People Clinging To A Thread — Half Breed — The Greatest Song I Ever Heard — How Can You Mend A Broken Heart — Carousel Man — David's Song — Melody — The Long And Winding Road — This God-Forsaken Day — Chastity Sun. (L.D.S.)

* * *

PRESENTING NANA MOUSKOURI . . . Songs From Her TV Series. Stereo, Phonogram 6312-036.

In a gentle, intimate style, Nana Mouskouri sings again some of the songs from her TV series. Recorded in the Chappell Studios, London, she is variously backed by the Athenians, the Peter Knight Orchestra, The Alain Goraguer Orchestra and the Mike Sammes Singers.

The titles: I Have A Dream — Blow The Wind Southerly — Open The Door — Morning Has Broken — Imagine — My Colouring Book — And I Love You So — Let It Be — The Bonnie Banks Of Loch Lomond — Children Of The Stars — If You Love Me.

The recording quality is good and this must rate as a thoroughly pleasant album. (W.N.W.)

* * *

JOHNNY YOUNG, JAMIE REDFERN The Young Talent Team Sing The Hits. Stereo, L&Y Harlequin series (Festival) YTT-1056.

We passed this one over earlier but Festival release sheets indicate that it is still prominent among the successful Harlequin series titles. Undoubtedly, its appeal is in the youth and freshness of the performers — ten young people whose very pleasant pictures are featured on the jacket.

And the titles are popular, too: Sing — Long Haired Lover — Close To You — Waltzing Matilda — Just Another Rock And Roller — I'll Never Find Another You — Tie A Yellow Ribbon — I Am A Woman — Puff The Magic Dragon — Puppy Love — Young Girl — Funny Face.

The quality is good and, in its own way, it is quite an appealing album. (W.N.W.)

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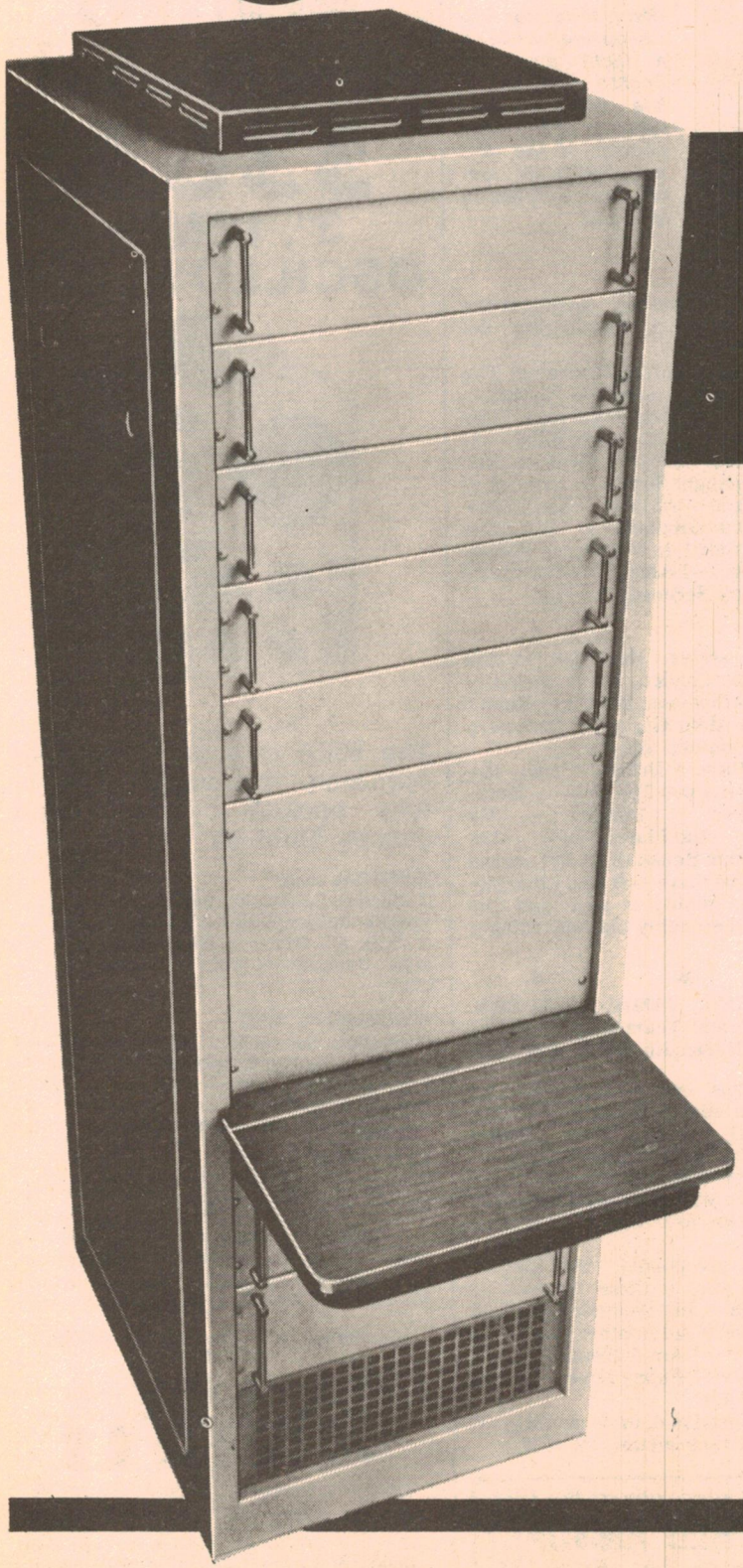

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Product reviews & releases

Sony TC-146A portable cassette deck

Many hifi enthusiasts would like to own a high quality stereo cassette deck but at the same time they would like a portable cassette player so they can listen to Bach on the beach, in the car or on a camping trip. If you are in this position, the Sony TC-146A is well worth considering.

The Sony TC-146A has features which will appeal to many cassette recorder users. It can record stereo cassettes and play them back in the home via a stereo amplifier. Away from the home, it can play back cassettes in mono via its internal loudspeaker, or in stereo via the headphone socket. At the same time, it can record either in mono via its internal "electret" microphone or in stereo with two external microphones.

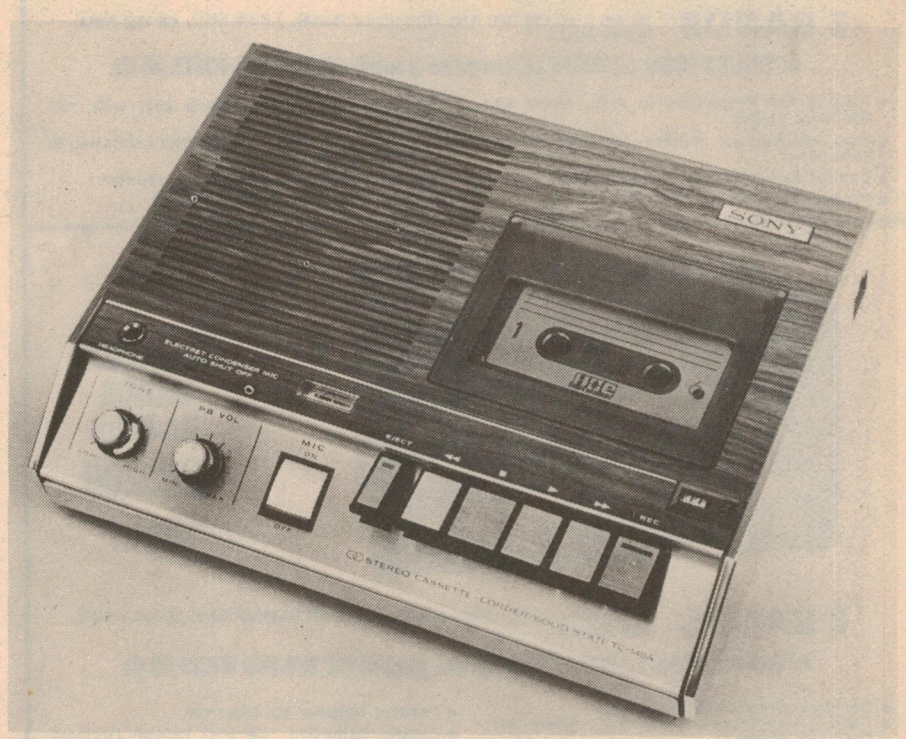
Powering arrangements can be equally flexible. First, the TC-146A runs from its internal batteries or an optional rechargeable battery pack. Alternatively, you can run it from a 6V adaptor in a car or boat. And it also runs directly from the 240V AC mains supply. All this in a compact package measuring 284 x 66 x 217mm (W x H x D) and weighing 2.8kg including batteries.

On the left side panel of the machine is a grouping of input and output sockets. Line input and outputs are provided both in RCA phono sockets and a five-pin DIN socket. In addition, there are two microphone sockets with a parallel socket for remote start and stop plus a socket for an eight-ohm earpiece.

The transport mechanism is straightforward to use and requires little comment apart from stating that it has good positive feel about the controls. While the tape is running, it is not possible to accidentally eject the cassette but you can use the eject lever to flip open the cassette cover to observe the progress of the tape.

The electret microphone is one of the neater features of the TC-146A. When not in use, it is covered by a shutter which also operates the switch to take it out of circuit. When recording with the inbuilt microphone, all other input sources are disconnected. In view of this, it was a little surprising that the internal microphone is recorded on one track only, instead of taking advantage of the improved signal to noise ratio if two tracks were used for the mono recording. Possibly the extra complication in signal switching was not considered worthwhile.

At any rate, we found the signal-to-noise ratio and overall recording quality from the internal microphone quite good, considering the likely uses such as lectures, conferences, tape correspondence and dictation. We had suspected that the microphone would pick up motor noises from within the unit but we could hear absolutely no motor noises at all.



A small meter is provided to give an indication of recording levels and the state of the battery during playback. As a recording meter it is almost useless, however, due to the perfunctory calibrations. Presumably Sony have made the assumption that signal monitoring is really unnecessary, as recording overload is avoided by the inbuilt limiter circuitry.

In practice, no signal limiting takes place below 0dB reference level which is produced by an input signal of 60mV RMS to the Line sockets. Above this the limiter acts very sharply with an attack time of about 1 second and a release time of 30 seconds or so. We were able to verify that the limiter has a range of at least 40dB, over which it keeps the recording level to within plus 3dB of 0dB reference level and distortion to a few per cent.

This means that one can shout into the microphone without overloading the circuitry. For best results on recording music via the line sockets, the average signal level should be kept below 60mV RMS, say around 10 to 15mV or so, to obtain a good dynamic range.

With good quality low-noise tape, frequency response is quoted at 40Hz to 10kHz, with no tolerance limits. We used a Sony low-noise cassette to perform the tests. Following our usual practice, frequency response was taken at minus 20dB below reference level. And we did in fact obtain a response within plus or minus 3dB from 40Hz to 10kHz — which is exceptional, for two reasons.

Firstly, very few tape machines actually meet their frequency response specification, which is often so vague that it is meaningless. Sepondly, many machines costing much more than the Sony TC-146A do very little better in their frequency response, even when using chromium dioxide tapes.

Signal-to-noise ratio was quoted as 45dB; we measured noise as minus 42dB with respect to 0dB reference level. Harmonic distortion was quoted as 2.5 pc. We measured total harmonic distortion at 0dB at 1kHz at less than 3 pc which is reasonable considering that any wow and flutter tends to make the measurement difficult. As an indication of the limiter performance, we also measured THD at plus 20dB which gave a result of less than 5 pc.

Wow and flutter was quoted at 0.22 pc and while we did not have the facilities for measurement we did verify that it was low enough to be unobtrusive.

Music reproduction via the internal amplifier and loudspeaker was of portable radio quality only, but via a pair of stereo headphones or an external stereo amplifier and loudspeakers it was very pleasant indeed.

So there it is. A multi-purpose machine which performs well and has no fancy gimmicks. Recommended retail price is $189 including sales tax. The Sony TC-146A is available from Sony retail outlets throughout Australia. For further information, contact your local Sony outlet or the Australian distributors for Sony equipment, Sony Kemtron Pty Ltd, 469-475 Kent Street, Sydney, NSW 2000. (L.D.S)

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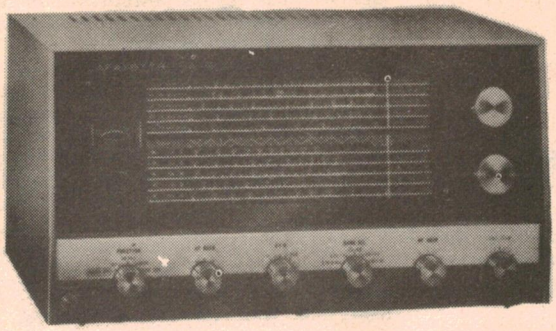

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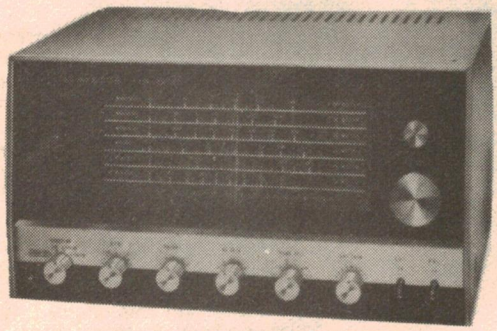

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NEW PRODUCTS

New transformer for Playmaster 136

A new product on the market will be of special interest to those readers who may have been experiencing difficulty in obtaining a power transformer for the popular Playmaster 136 amplifier. Solidly made and generously proportioned for the job it has to do, the transformer is a product of Hallam Magnetics Pty Ltd, of 40-42 Fitzroy St, Marrickville, NSW, 2204. The type number is HM 4218. Hallam Magnetic normally supply through trade stockists but individual orders can be filled for this particular item.

New LED range

Allied Capacitors have announced a new range of seven segment LED displays from Monsanto.

Identified as the MAN50 (green), MAN70 (red), and the MAN80 (yellow) series the new range offers common anode, common cathode, right-hand and left-hand decimal, and plus-minus-one overflow digits in red, yellow and green. All units are IC compatible, are in standard 14-lead DIP packages, and have 0.3-inch digits.

All units, including the yellow MAN80 series, are highly legible, with bold, solid segments and excellent contrast enhancement.

For further information contact Allied Capacitors Pty Ltd, PO Box 198, Brookvale, NSW 2100. Telephone 938 2135.

Radio pioneers from p29

in saving life during the "Titanic" disaster of April 1912, focussed world attention on the new science. Shipowners hastened to equip their vessels with spark transmitters and adventurous Australian youths flocked to become marine operators. The Marconi School of Wireless, with George Apperley as chief instructor, was organised to train them.

And although no one realised it in 1913, there was an even more compelling reason for Australia to be self-sufficient in wireless. During the coming year a Serbian zealot would murder an Austrian archduke, lighting a powder trail that exploded around the globe. The demands of war would extend the horizons of wireless enormously and affect Australia's future in countless ways.

Low cost stereo amplifier

Dick Smith Wholesale Pty Ltd are marketing a small low cost utility stereo amplifier module which should have particular appeal to the hobbyist with limited time available for construction. Completely wired apart from controls and power supply, it uses discrete transistors and will deliver more than 6 watts RMS per channel.

The basic amplifier module consists of a printed wiring board measuring 11.3 x 9cm, to which is attached a wrap-around aluminium bracket. The bracket forms both a heatsink for the two pairs of plastic power transistors, and a support for a second small board which mounts the components associated with the tone controls. The smaller board measures 7.5 x 5 cm and is attached to the bracket via moulded nylon standoffs.

As offered, the two boards are fully wired and interconnected, and are also provided with all the leads for connection to the power supply and controls. The leads are pre-attached to the module, and are ready tinned at their far ends.

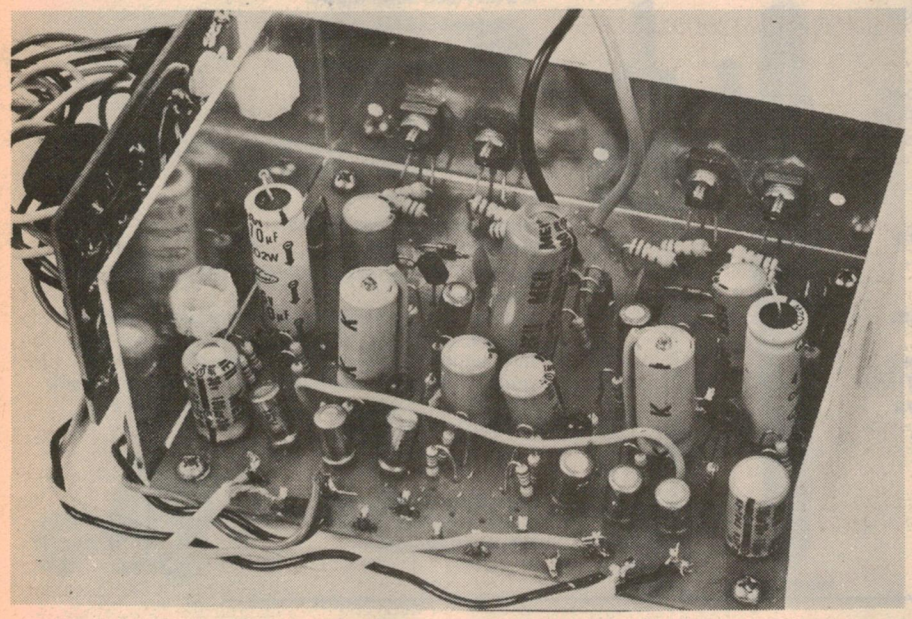
One can either buy the module in this basic form, and incorporate it into existing equipment, or alternatively buy it in "expanded kit" form with either the necessary control pots alone, or both the pots and a set of suitable power supply components. In this final form, you will have virtually the complete "works" for a medium-quality stereo amplifier system, at a very attractive cost.

Each channel of the amplifier consists of a one transistor preamp stage, a passive tone control network and a power amplifier. The power amplifier is of fairly conventional design, using a complementary class-B output stage. There are four transistors in each power amplifier, with a reasonable amount of negative feedback to reduce distortion and noise. The output is capacitively coupled to the speaker, via a 470uF electrolytic. Most components in the module appear to be manufactured by Philips, apart from the semiconductors. The plastic power transistors appear to be from Motorola.

As sold by Dick Smith Wholesale, the modules are accompanied by a wiring diagram, a circuit diagram and a set of instructions detailing the method used to complete the wiring. We found these accurate and easy to follow. The instructions consist of two stages, "identifying connections" and "wiring procedure."

In order to test both the amplifier and the wiring instructions, we assembled a sample kit by strictly following the suggested procedure.

The suggested rating for the power supply is from 24 to 30 volts and 1 amp. We used a 21.5V transformer in conjunction with a diode bridge. We understand that a 1000uF capacitor is being recommended for use as a filter, but we used a 2500uF one, and from the level of hum that we obtained, we feel this is a more suitable value. It would be possible to use a lower voltage transformer than we used, but the power available from the amplifier would be limited. A higher value is not recommended, as this would be exceeding the recommended ratings.



We mounted the control potentiometers on a small aluminium panel. We found it necessary to earth this panel to the negative rail of the power supply to eliminate 50Hz hum. This procedure is also highly desirable as a safety precaution, to prevent possible dangerous voltages on the panel and knobs.

The claimed power output was "25 watts peak total power" or "12.5 watts RMS total power" into either 4 or 8 ohm loads. At 1kHz we obtained 6.8 watts with one channel driven and 6.6 watts per channel with both channels driven at an impedance of 8 ohms. This is slightly above the claimed values. However with 4 ohm loads, we could only obtain 4.9 watts with a single channel driven and 4.4 watts both channels driven. With 16 ohm loads we obtained only 4 watts per channel. It would therefore seem that to obtain maximum power from the amplifier, 8 ohm speakers should be used. Happily this is now a very popular value.

With an 8 ohm load, and a test frequency of 1kHz, the overall sensitivity was 5mV to produce the rated output. The signal-to-noise ratio was better than 55dB, and the cross-talk was less than —55dB. The major component of the noise was hum introduced through the power supply, although as the figure suggests, the hum was only just audible on a listening test.

It is probably in terms of distortion that the limitations of the amplifier become most apparent. At a power output of 6 watts into 8 ohm loads with both channels driven, the distortion of a 1kHz signal was 1.8pc in one channel and 1.4pc in the other. At a 3 watt power level, these figures dropped to 1.2pc and 0.85pc respectively, while at a 1

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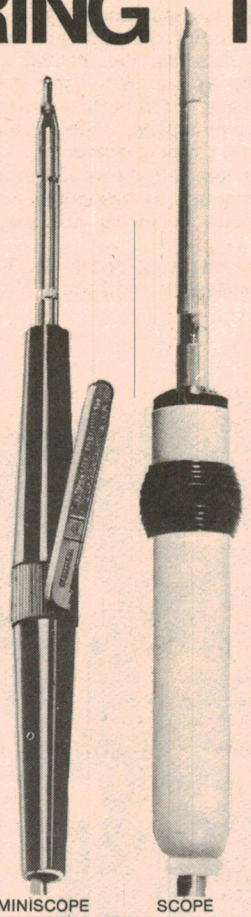

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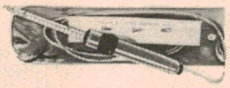

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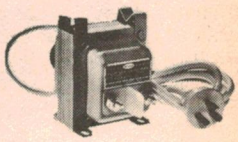

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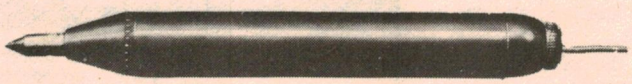

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watt level, the values were 1.1pc and 0.8pc respectively. These values are rather higher than those normally accepted for a high quality amplifier, but considering the distortion likely to be present in the other components of a modest stereo system, they are still quite acceptable.

The frequency response is quite good, with a bandwidth from 40Hz to 80kHz (+0dB, —3dB). The treble control gives 10dB boost and 13dB cut at 10kHz, while the base control gives 11dB boost and 8dB cut at 100Hz.

Our next test was to evaluate the amplifier in use with a typical ceramic cartridge. Because of the low input impedance of the amplifier (approximately 50k), it was necessary to apply some frequency compensation to obtain a reasonable base response. One method is to use a 2Mohm resistor in series with the cartridge to raise the input impedance of the amplifier. This can lead to problems of hum pickup, however.

The alternative approach, and that recommended, is to use a shunt capacitor. The value of capacitor used is a compromise between the amount of signal obtained and the low frequency response. Too large a value gives a good low frequency performance, but limits the available signal level. We found that the recommended value of .068uF gave acceptable performance with a typical ceramic cartridge having medium output and source capacitance.

A final listening test proved to be quite a pleasant experience. The distortion was not noticeable, the base response was acceptable and the volume obtained was sufficiently high for most purposes. Our overall impression was that while not of the highest "hi-fi" quality, the amplifier is very good value for money.

All told, it would seem very suitable for all of those "utility" audio applications where the ultimate in high fidelity is not necessary. The fact that it is pre-assembled should prove an additional advantage.

Price quoted for the basic module is $14.95, with post and packing $1.00 extra. With the control pots added the price is $19.95 (p and p $1.50), and with the power supply components as well $29.95 (p and p $2.00). Further information from Dick Smith Wholesale Pty Ltd, 160-162 Pacific Highway, Gore Hill, NSW 2065. (D.W.E.)

Audio test units from Tecnica Elettronica

Tecnica Elettronica System is an Italian electronic test equipment manufacturer whose range of instruments is distributed in Australia by Jacoby, Mitchell & Co Pty Ltd. Included in the range is the Model MU 472 Output Power Meter and the model OM 866 Modulated Oscillator.

The two instruments mentioned above were submitted to us for review. The model MU 472 is intended for measurement of audio amplifiers. Dimensions are 200 x 160 x 260mm (W x H x D) and weight is 3kg. It has a large meter measuring 120 x 55m which is clearly calibrated in watts and decibels.

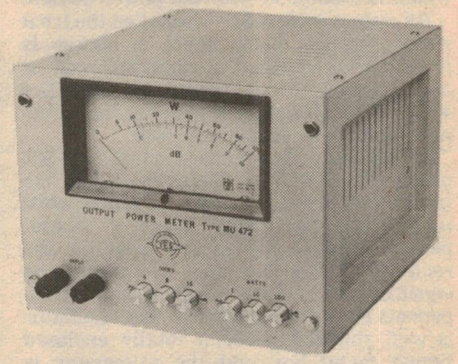
Overall finish of the instrument is light-grey crackle finish enamel. An interesting feature is the ventilated side plates of the case which are aluminium diecastings rather than punched sheet metal.

Push buttons provide range selection of 1, 10 and 100 watts and the load resistance of 4, 8 or 16 ohms. The load resistors are finned metal-sheathed types mounted on double-sided heatsinks inside the well-ventilated case. Resistor tolerance is 5 pc.

Frequency range of the instrument is 20Hz to 50kHz while the claimed accuracy is within 0.5dB. Since the circuitry is passive, containing a meter bridge rectifier and protection diode plus the load and multiplier resistors, the instrument does not require a power source. This is a handy feature as it minimises the number of power outputs needed on a test bench.

Accuracy of calibration only applies to sinusoidal waveforms. Power indications on square waves or other signals or sine waveforms when the amplifier is overloaded, will be incorrect.

On test, the sample unit proved to be well within specification. Inside and out, it gives



the impression of being a rugged well-built instrument that should give years of reliable service. It is entirely suitable for use on the production line or the service technician's test bench.

One drawback with the unit is that the instruction manual is printed only in Italian. While admittedly this is not too much of a problem with a simple instrument of this sort, presumably the local distributor will arrange for a manual to be printed in English.

The Modulated Oscillator OM 866 is a slightly larger instrument with dimensions 300 x 160 x 260mm (W x H x D) and weight 6kg. Finish is again similar to the Power Meter. A large circular dial carries the six frequency ranges, which are from 140kHz to

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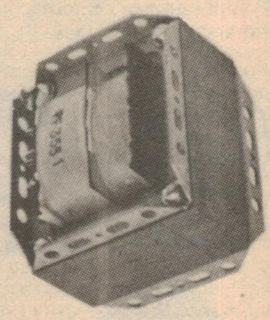
PF 3784	210	7,14,28,35,42,56,63,70V OR 6.5,13,26,32.5, 40,52,57.5,65V At 3 AMPS OR 7.28, 35V At 6 AMPS OR 6.5,26,32.5V At 6 AMPS. Fitted with E.S. Shield.
PF 3783	350	7,14,28,35,42,56,63,70V OR 6.5,13,26,32.5,40,52,57.5,65V. At 5 AMPS OR 7,28,35, At 10 AMPS OR 6.5, 26, 32.5V at 10 AMPS. Fitted with E.S. Shield.



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45MHz. There are five knobs for range selection, tuning, attenuator, attenuator multiplier and the modulation selector which is combined with the power switch.

RF output is via a BNC socket on the front panel. On the back panel a socket is provided for external modulation input or access to the internal modulation signal of 400Hz. Also on the back panel is the three-pin mains cord socket and fuse.

Surprisingly, the unit uses valves. The RF oscillator uses a twin triode while the modulator-buffer and phase-shift modulation oscillator share a triode-pentode. Silicon diodes are used for the rectifier. Inside the unit, we found the construction rugged. High quality components are used throughout. The oscillator is well shielded inside a totally enclosed tinned metal box and the attenuator is similarly well shielded.

Our only complaint with the construction was that the upside-down mounted oscillator valve was not fitted with a clip to secure it into the socket. This was probably an error in assembly of the sample unit, as the socket had provision for a clip.

Specifications are as follows: Frequency range, 140kHz to 40MHz; 30 pc amplitude modulation at 400Hz; external modulation frequency range, 20Hz to 15kHz; Maximum RF output, 0.2V plus or minus 3dB; RF output impedance, 75 ohms; Dial Accuracy, plus or minus 1 pc except for band 430 to 530kHz, plus or minus 0.1 pc; Signal radiation, less than 5 microvolts.

Set up on the bench, the unit performs well. We would have preferred a larger

tuning knob to give a better "feel". Still, as it is, the dial drive is satisfactory although it is a little on the tight side presumably as a result of precautions to eliminate blacklash. Dial accuracy is very good and well within the tolerances listed.

We had no precise means of measuring the leakage signal radiation from the oscillator but listening tests seem to indicate that the maximum of 5uV is a credible figure. Stability is reasonable for an instrument of this sort.

We can sum up the instrument by stating that it is well made and is well suited for production line, service or hobbyist use. Once again the unit has an Italian manual and was supplied to us without the correct three-pin plug on the mains cord. Presumably this will be attended to on the instruments as presented for sale.

Price of the MU 472 Power Output Meter is $182.00 duty paid while the OM 866 Modulated Oscillator is $132.82. Both prices include sales tax. Further information regarding the TES range of equipment can be obtained from the Australian disbributors Jacoby, Mitchell Limited, 215 North Rocks Road, North Rocks, NSW 2151. (L.D.S.)

Monitor from p43

move is to set all adjustment points to a position which will help the adjustment procedure. The vertical position, horizontal position, focus and astigmatism controls are set to mid-position. The sync level, contrast and vertical sync level controls are all set right off. Set the frequency adjust pot to a value of 27k and the feedback pot to 15k. The slug in the video discriminator coil may be set so that the slug is fully inside the coil, with the respective ends about flush.

For adjustment purposes, the use of a CRO, an audio generator and possibly a VTVM will be assumed. After switching on, a routine check of voltages may be made. Make sure however, that there is not a well focused bright spot on the CRT screen, which may lead to phosphor burning. With voltages checked and if the aforementioned spot has not yet appeared, rotate the horizontal and vertical positon controls untl the spot is found. A rough adjustment of the focus and astig controls may be made and then the spot should be shifted just off the screen for the time being at the bottom right.

Connect the CRO (or VTVM) to the junction of the 2.7k resistor and the 10uF electrolytic at the op-amp output, and connect the audio generator to the input socket. Feed in any frequency between 1200Hz and 2300Hz. Limiting should occur with less than 100mV input and the saturated output will be about 30V peak-to-peak.

To adjust the video discriminator coil, connect the CRO to the junction of the coil and 18k resistor. Set the audio generator to 2300Hz and output level to 100mV. Adjust

(Continued on page 110)

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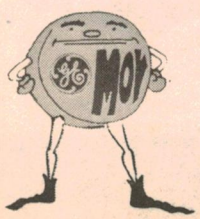

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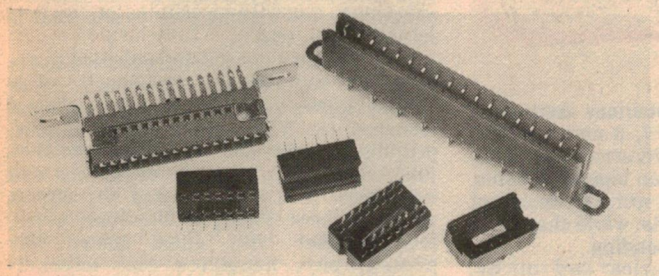
McMurdo socket and connector range expanded



Pictured above are some of the items currently included in the McMurdo range of sockets and connectors.

In the foreground are typical 14-in-line and 16-in-line IC sockets, with external pin spacings identical to those of the IC which they are designed to mount. The sockets can therefore be interposed between the printed wiring board and the relevant integrated circits, avoiding possible heating problems and allowing the ICs to be plugged in.

To the right is a typical PC (printed circuit) edge connector from the McMurdo "Redline" range. In fact, the unit pictured is as supplied for the Playmaster 140 quadraphonic amplifier, with end brackets for chassis mounting. Redline connectors can be supplied to order in various configurations. Alternatively packaged kits are available allowing the customer to make up connectors to meet immediate needs.

Most recent addition to the range is the Ferranti EZD series connector pictured at the left. McMurdo claim that the EZD connectors are manufactured to particularly high standards. The base moulding is of glass-filled diallyl phalate, while the contacts are carefully fabricated to maintain a reliable connection without exerting so much pressure as to damage the mating surfaces, or to make insertion and withdrawal difficult.

The Ferranti EZD connectors can be supplied with tails for wire wrapping, or for normal soldering, or for insertion into PC boards. Contact positions can be identified numerically on the underside of the moulding by request.

McMurdo hold stocks in Australia from which they can supply EZD connectors of 0.1in pitch, up to 89-way, either single or double sided. Connectors from the EZD range, but with 0.15in spacing are available on indent only in 8, 16, 24, 32 or 40-way. In addition, 22-way 0.156in connectors can be obtained to order.

Further information on the above items can be obtained from McMurdo (Australia) Pty Ltd, 17-21 Carinish Rd, Clayton Vic 3168, or 219 Blaxland Rd. Ryde NSW 2112.

New digital thermometer

Hewlett Packard have announced the release of a new dual-range digital thermometer.

Designated the Model 2802A, the new instrument features all solid-state circuitry and an all solid-state display, making it particularly suitable for field use. The two ranges read from -200 — +600deg C and from -100 — +200deg C with resolutions of 0.1deg C and 0.01deg C respectively. A linear analogue output enables the Model 2802A to be used with any standard chart recorder.

Price of the Model 2802A (without probes) is $543, excluding sales tax. For further information contact Hewlett Packard Australia Pty Ltd, 31-51 Joseph St, Blackburn, Victoria 3130. Telephone 89 6351.

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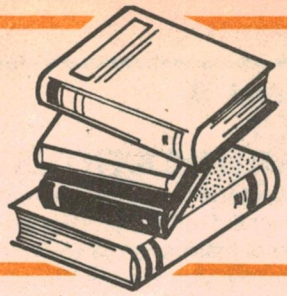

Books & Literature

IC handbook

A USER'S HANDBOOK OF INTEGRATED CIRCUITS, by Eugene R. Hnatek. Published by John Wiley and Sons, New York, 1973. Hard covers, 260 x 180mm, 449pp, many circuits and diagrams. Recommended price $24.95.

A comprehensive treatment of modern ICs, but orientated towards the end user rather than the solid state physicist or fabrication specialist. It deals with fabrication, operation and application of virtually all types of digital and linear devices in present-day use, at what is basically a serious qualitative level. The author is linear IC marketing manager for the Signetics Corporation.

The book is divided into six main parts. Chapter 1 introduces the major IC technologies, and compares them with discrete component technology. Then in chapter 2 the author delves more deeply into bipolar technology, and uses this to show the trade-offs inherent in monolithic circuits. In chapters 3, 4 and 5 digital bipolar devices are then discussed, with design, types and applications treated in that order. Chapters 6, 7, 8 and 9 give a similar treatment for MOS arrays, while 10, 11 and 12 deal with linear bipolar devices. Chapters 13 and 14 deal with the design of thin and thick film circuits, while chapter 15 covers packaging and bonding.

The text throughout is clear and concise, and very readable. This and its comprehensive scope should make the book equally suitable either as a reference for the practising circuit designer, or as an introductory text for engineering students.

The review copy came from the Australian office of the publisher, John Wiley and Sons Australasia Pty Ltd. Copies should be available at all major bookstores. (J.R.)

Encyclopedia

HOW THINGS WORK, the Universal Encyclopedia of Machines. Published by Paladin Books, St Albans, UK, 1973. Paperback, 135 x 195mm, 590pp, more than 1000 coloured illustrations. Price $3.90 plus 50c post and packing.

This is one of the most fascinating little books I've come across for a long while. For anyone with even a spark of technical interest or curiosity, it's almost impossible to put down once you've picked it up. You find yourself darting back and forth from item to item, devouring the brief but generally succinct descriptions of the operation of all manner of technological artefacts. No sooner do you find your curiosity satisfied with one item, but you find yourself thinking of another, and turning over to see what is written about that . . .

It's virtually a concise introduction to the whole of 20th-century technology, from clothes zippers through door locks and blast furnaces, shock absorbers and gearboxes, printing presses and steam locomotives, juke boxes and gliders, to cyclotrons and computers. You name it, and it's almost certainly there. Plenty of electronic items, too, together with allied topics like photography, acoustics and telecommunications.

It won't make you an instant authority on all branches of technology, to be sure, but it should certainly help satisfy anyone's curiosity as to the basic principles involved in most areas. For anyone with growing children, it would be an almost essential addition to the family reference shelf. At the price quoted, it really is outstanding value.

The review copy came from Dick Smith Wholesale Pty Ltd, of 169 Pacific Highway, Gore Hill 2065, who advise that they are happy to supply by mail. (J.R.)

A-D conversion

ANALOG-DIGITAL CONVERSION HANDBOOK, edited by Daniel H. Sheingold. Published by Analog Devices, Inc., Norwood, Massachusetts, 1972. Soft covers, 210 x 140mm, many diagrams. Price $5.00 plus postage where applicable.

Most applications handbooks put out by device or subsystem manufacturers are rather specialised in appeal, and heavily orientated towards the products of the firm concerned. Happily this is one of those rare exceptions, in which the temptation to push the firm's own particular products has been kept under very tight control. In fact one almost feels that practical examples of techniques, as embodied into the firm's products, are not given frequently enough! But the nett result is a very well written and concise reference book on A-D conversion, one which should be found of considerable value by anyone seeking to understand, specify or use A-D converters and systems.

The book is divided into four sections, headed 1 — Converters at Work; 2 — Converters; 3 — Other System Components; 4 — Guide for the Troubled. These contain five, five, four and one chapters respectively.

The text is written in clear and concise language, and is well served by illustrations. In short, it would be a very worthwhile addition to your reference shelf if you work with A-D converters, or hope to.

The review copy came from the Australian representatives for Analog Devices, who are Parameters Pty Ltd, 68 Alexander St, Crows Nest 2065. Copies are available by mail order. (J.R.)

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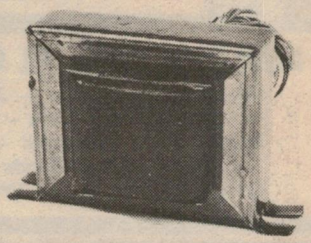

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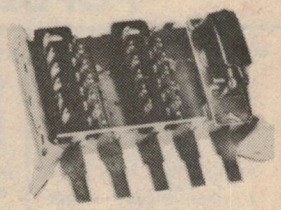

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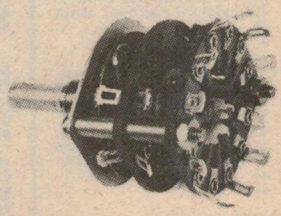

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The Amateur Bands

by Pierce Healy, VK2APQ

Help the IARU to Help You

The future of amateur radio, along with other worldwide communication systems, rest in the decisions made at International Telecommunication Union Conferences. Amateurs are represented at such conferences by the International Amateur Radio Union.

The International Amateur Radio Union was founded n 1925 and is the official amateur organisation recognised by the International Telecommunication Union. IARU membership is open to national amateur radio societies throughout the world, but only one society from any country is eligible for membership.

The IARU has three regions, according to geographical location.

Broadly, Region I covers Europe, Africa and parts of Asia. Region II covers North and South America. Region III, Australia, New Zealand, Japan, Oceania and South-east Asia.

Administrative cost of the IARU headquarters is underwritten by the American Radio Relay League. However, with the establishment of regional organisations, it was decided that each area finance its own activities. This is by a levy on each member society based on a nominal amount per individual member.

Support of your national amateur radio society also supports amateur radio worldwide.

Until 1972 the offices of president, vice-president and secretary were filled by those holding the counterpart offices in the ARRL. However, when Harry Dannals, W2TUK, was elected president he expressed the view that the duties as IARU president demanded a full-time officer and the ARRL board of directors nominated his predecessor, Robert Dennison, W0DX, to continue in the IARU office.

Robert Dennison has now indicated that he is unable, due to pressure of personal affairs, to carry on as IARU president. In his place the ARRL has nominated Noel B. Eton, VE3CJ. The proposal has been circulated to all the member-societies. For many years Noel Eaton served as ARRL Canadian Division director and is a newly elected vice-president of the League. He has extensive experience in IARU affairs, including attendance at the 1971 ITU Space Conference, and service as treasurer and executive committee member of the Union Interamericana Radioafficiondos — IARU Region II.

Victor C. Clark, W4KFC, newly elected first vice-president, ARRL, also becomes an IARU officer, while John Huntoon, W1RW, continues as secretary.

Another proposal before IARU member-societies is an application for membership by the Radioklub der DDR.

REGION I

Member societies of the Region I Division have revised the 144MHz and 432MHz band plans. This plan provides for the use of 145.854MHz to 146.00MHz by amateur satellites.

The president of the RSGB, Mr G. R. Jessop, G6JP, made these observations in a message to members:

"... the problems of conserving our band allocations are becoming more acute. In 1979 there will be a World Administrative Radio Conference during which there will be many claims for a share of the spectrum.

"The society is already making preparations by discussions with our administration, the Ministry of Posts and Telecommunications, and we are supporting the IARU Region I Division in its efforts to convince other member societies of the need for the closest liaison with national administrations.

"For our own part we need the support of every amateur, and we must show that we are a responsible body of enthusiasts engaged in a progressive and useful hobby."

Mr G. R. Jessop, G6JP, was installed as the 40th RSGB president on 4th January, 1974.

REGION II

At a conference of societies in 1973, at Santiago, Chile, delegates concluded that very few amateurs realised the extent to which their national society is contributing funds and effort to strengthen amateur radio. The conference decided that each society should give more publicity to this activity.

Because of the large membership of Canadian and US members the ARRL contributes some $4,500(US) to the Region II organisation.

REGION III

To the end of March 1974, no information had been publicised through WIA news media regarding a Region III Association meeting this year.

In view of the preparations being made in other countries, many amateurs are expressing concern at the apparent lack of action on plans for representation to administrative authorities on matters that may affect amateur radio.

However, hope has been expressed that the matter would receive attention at the WIA federal convention in Sydney at Easter.

LOCAL AND OVERSEAS NEWS

Amateur Radio in Morokulien

The name Morokulien is derived from the Norwegian and Swedish words "moro" and "kul" which mean "fun." It is the name of a "country" of several square kilometres between Norway and Sweden.

This land was set aside in 1958 in connection with efforts to promote various charities, among them two memorial assistance funds for handicapped radio amateurs in the neighbouring countries.

The Norsk Radio Relae Liga (NRRL) and Foreningen Sveriges Sandareamatorer (SSA) oversee the operation of the funds, which honour LA5LG and SM5WL. The special memorial call signs LG5LG and SJ9WL are used from a permanent amateur station set up in a cottage which may be rented on a daily basis by any licensed amateur.

The cottage has four beds, a well-furnished kitchen, a verandah and — of course — a radio room and lots of antennas. All proceeds from the rental of the cottage and other related projects are used to assist handicapped amateurs in Norway and Sweden.

Should you be planning to visit Scandinavia, complete rental information is available from ARIM, N-2242 Morokulien, Norway, or ARIM, S-67044 Morokulien, Sweden. Please include sufficient postage for the reply.

Australia

The Annual General Meeting if the NSW division, WIA, was not held on Friday, March 22, 1974, as intended. Two factors caused a postponement. First, a query regarding the validity of the form in which notice of the AGM was given. Secondly doubts were expressed if a quorum was actually present. As the legal adviser was not present, the chairman ruled that the meeting not proceed and that a new notice would be sent to members calling for the AGM to be held on Friday night, April 26, 1974.

The Victorian Division, WIA, have sold their property at 478 Victoria Parade, East Melbourne, headquarters of the division for many years. Negotiations were to be finalised by the end of March, 1974, for the purchase of a property in Brunswick Street, Fitzroy, for $68,000. The property has all the potentials to cover the facilities required, there being no restrictions by the local municipal authorities.

Moonbounce Tests

A visitor to Sydney during mid-March, 1974, was Chris Skeer, VK5MC, of Millicent, South Australia, whose achievements with 144MHz moonbounce experiments were recorded in the December, 1973, and January, 1974, notes.

A very interesting and enlightening evening was spent with Chris, discussing some of the technical as well as physical problems associated with equipment and antennas for E-M-E tests.

The most interesting topic was the strength of signals received during E-M-E tests, since only about seven per cent of the signal transmitted is reflected from the surface of the moon. This aspect was demonstrated by a series of tape recordings. These included:

- —Reception of his own 144MHz signals from the moon.
- —Signals from W6PO and VE7BQH at VK5MS via E-M-E on 144MHz.
- —144MHz signals from VK5MC, 432MHz signals from VK2AMW, at Dapto, NSW, and 1296MHz signals from VK3AKC, at Geelong, Victoria, as received at the United States Naval Research Laboratory via E-M-E.
- —Signals received at the laboratory from amateur stations in the USA, Canada and England.
- —144MHz ground wave signals from VK3ATN 240kM north-east of VK5MC and the same signal received via E-M-E giving an uncanny echo effect.
- —a sample of E-M-E QRM from a Canadian station attempting to break-in on a 144MHz contact between VK5MC and two stations in the USA. It was not realised that the interference was being caused by another E-M-E amateur station until a report on the test was received from the Canadian station.
- —The effect of audio filters used to eliminate some of the band noise received during E-M-E tests.

The signals varied in strength and readability but, nevertheless, were remarkable considering the distance traversed, the power used and the relatively modest equipment employed.

These experiments should add status to amateur radio and be an incentive to others to take up a fascinating aspect of UHF-VHF communication.

VHF-UHF Contest Results

There was an increased number of logs received in the 1973-1974, "Ross Hull VHF-UHF Memorial Contest." From comments accompanying the logs it was a most enjoyable contest. The great majority of contacts were on the six metre band and a few on the 1296MHz band.

The trophy winner was Kerry Adams, VK5SU, with 7300 points. The certificate for highest score in a 48-hour period was won by Stephan Gregory, VK3ZAZ, with 2211 points. VK5SU operated in the "Transmitting open" section and VK3ZAZ in the "Transmitting phone" section. Only one log was received for the "Transmitting CW" section.

FM Broadcasting Inquiry

It was stated in the WIA, Victorian division broadcast on Sunday, 17th March, 1974, that a submission, similar to the recommendation now likely to be adopted, was submitted to the FM inquiry on behalf of the WIA. The submission was prepared by the WIA UHF-VHF advisory committee.

Mobile Contest Suggestion

Sid Molen, VK2SG, has put forward a proposal for an Australian and World Wide Mobile Contest. Suggested rules are:

- —Contacts may be mobile to mobile; mobile to fixed stations, on any band.
- —Contacts to be 'phone, CW or cross mode. No cross band.
- —No beams or fixed aerials to be used by mobile stations.
- —Mobile stations must operate from the normal vehicle electrical supply.
- —The contest to be confined to land mobile stations.
- —Mobile stations to multiply points scored by kM travelled during the contest, divided by the number of operators.
- —Only one contact per station per band.
- —Entries to include a complete discription of the gear used together with a map of the route taken during the contest.

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent direct to Pierce Healy at 69 Taylor Street, Bankstown, 2200.

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AC187	80c	2N2926G	50c
AC187/188	1.55	2N3053	80c
AC188	75c	2N3054	1.00
AD149	1.30	2N3055	1.30
AD161	1.20	Mat. Pr.	2.80
AD161/162	2.40	2N3638	35c
AD162	1.20	2N3638A	40c
BC107/108/109	25c	2N5459	1.20
BC177/178/179	50c	2N5485	1.20
BD139	1.20	**DIODES**	
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BD140	1.50	BA102	60c
BF115	50c	OA5	35c
BF167	60c	OA90	15c
BF173	75c	OA91	15c
BF177	1.00	OA95	25c
BFY50	80c	OA202	20c
BRY39	1.00	1N914	15c
D13T1	80c	1N4004	20c
OC26	1.50	1N4007	35c
OC28	1.50	BYZ13	75c
OC29	1.75	(6amp. 200v)	
OC35	1.50	**SILICON BRIDGES**	
OC36	1.75	1amp. 100v	70c
OC44	50c	2amp. 200v	1.30
OC45	50c	**ZENERS**	
OC71	50c	BYZ88 type	30c
OC74	50c	1.5 watt	70c
OC81	50c	**SCRs**	
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AMATEUR BANDS

—Check sheets to be included with contest logs and to be signed by two amateurs.
—The contest to run for 24 hours from 1000GMT on 23rd December to 1000GMT on 24th December.
—Scoring table; mobile to fixed station in same country, 1 point, Mobile to mobile in same country, 3 points. Mobile to fixed station another country, 5 points. Mobile to mobile station in another country, 10 points.

Comments should be sent to Sid Molen, VK2SG, at his call book address.

VK2WI Beacons

Beacon transmitters operate at the NSW / Division WIA, station at Quarry Road, Dural. These function continuously in the six and two metre bands:

52.450MHz — Power, 30 watts. Antenna, crossed dipoles stacked five-eights wavelength apart, 15 metres high.

144.002MHz — Power, 30 watts. Antenna, two ten element yagis, one beaming north and the other southwest.

Both transmit "VK2WI" every 40 seconds at 10 words per minute CW.

RADIO CLUB NEWS

Quarter Century Wireless Association

The monthly get-together of the Sydney Chapter, QCWA, was held at the RSL Memorial Club, North Sydney, on Wednesday evening 13th March, 1974. Members were pleased to welcome as their guest Jamison Rowe, Editor of "Electronics Australia."

After an enjoyable dinner the party adjourned to a private room where an informal discussion took place on VHF techniques and other technical topics. At the conclusion of the discussions, lasting about 90 minutes, members expressed their appreciation to their guest for his very worthwhile contribution to the discussion.

Membership is open to amateurs who have been licensed for twenty-five years or more. Details may be obtained from president — Harry Caldecott, VK2DA; secretary — Pierce Healey, VK2APQ, or treasurer — Brian Anderson, VK2AND, at their call book addresses.

Central Coast Amateur Radio Club

The annual meeting and election of officers of the Central Coast Amateur Radio Club was held on Friday, 1st March, 1974, at the club rooms, Dandaloo Street, Kariong, NSW. The officers elected were: President — Dick Maitland, VK2BBK; Vice-president — Ern Hodgkins, VK2EH: Secretary — Barry Gibbons, VK2-ZUX; Treasurer — Leon Brett; committee members — Ross Mudie, VK2ZRQ: Bill Smith, VK2TS; Ray Wells, VK2ZSX; Don Crutcher, VK2ZCZ; Bob Lean, VK2ZLY and Mrs Suzanne Wells, publicity officer.

At the social meeting on 15th March, 1974, a series of NASA films, organised by Gary Tippett, VK2UX, were screened. The films were of the Apollo 17 moon mission; ERTS — a research satellite; and Skylab, the orbiting space station. The forty persons present had a most enjoyable night and it was their hope that more of that type of film could be screened in the near future.

The CCARC meets on the first and third Friday evenings of each month and visitors are always welcome. Further information from the secretary, Barry Gibbons, VK2UX, telephone Gosford 251746 or PO Box 238, Gosford, NSW, 2250.

Illawarra Branch

E-M-E experiments on 432MHz by the moonbounce group of the Illawarra Branch, led by Lyle Patison, VK2ALU, have again been successful. Tests were conducted from the moonbounce station at Dapto on 2nd, 3rd and 9th February and 2nd March, 1974, under the call sign VK2AMW.

Weak signals were heard from W6FZJ on 2nd February who indicated that VK2AMW was being received reasonably well. Only echoes of the VK2AMW signals were heard on the 3rd and 9th February, which were up to 8dB above the noise on the 9th.

On 2nd March, 1974, an excellent two way contact was made with K2UYH in New York. The contact lasted for an hour. Signals from K2UYH peaked to 10dB above the noise and VK2AMW was also being received very well.

This test produced results far better than anything previously achieved, mainly as the result of the 8.5 metre dish antenna used by K2UYH. Linear polarisation at both stations may also have been a factor, although there would have been less fading had circular polarisation been used.

Tape recordings were made of the signals received, also some chart recordings. VK2AMW echoes were 6dB above the noise.

The next series of tests were scheduled for 31st March, 1974, when it was planned to use teletype (RTTY) for the first time.

Fixed station VHF activity by Illawarra Branch members has resulted in some good contacts on six and two metres. Mobile stations as far north as Raymond Terrace being worked on 146MHz FM from the Wollongong area.

Visitors are always welcome to the Illawarra Branch meetings. These are held on the second Monday of each month in the Wollongong Town Hall Committee Room at 7.30 pm. Further information from the secretary, PO Box 110, Dapto, NSW 2530.

Geelong Amateur Radio & TV Club

The Annual Geelong Hamfest, organised by the Geelong Amateur Radio & Television Club, will be held during the second weekend in May. In the March 1974 issue of the club's newsletter it is explained that the Hamfest is a convention with a difference. Not only are amateurs catered for, but also their XYL's, YL's, and harmonics.

The Hamfest is a weekend affair, with entertainment on the Saturday, 11th May, and field events, transmitter hunts etc on the Sunday.

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The first Geelong hamfest was in 1970, with an attendance of 90. Last year the attendance was 240. This is a good indication of the increasing popularity of the event.

Unfortunately at the time these notes were compiled no information was to hand on registration fees or accommodation.

As usual GARC members participated in the John Moyle Memorial National Field Day. Many stations were worked, from 3.5MHz to 144MHz, SSB and FM. The most activity was on 7MHz, 14MHz and 146MHz. According to a report some difficulty is being experienced in working out the total points scored. It seems the log keeper used hieroglyphics instead of English.

During February VK1VP in Canberra and VK2NN in Wentworth Falls in the Blue Mountains west of Sydney were worked on 144MHz by three Geelong stations, VK3AQR, VK3BMD and VK3BDL. At the time TV stations in southern NSW and Channel 5A in Wollongong were being received in Geelong at good strength.

A study group has been organised at the GARC for those intending to sit for the August AOCP examinations.

For details write to the Secretary, GARC, PO Box 520, Geelong, Victoria 3220.

OBITUARY

Chris Dein, VK2ZBK, passed away suddenly on Friday, 15th March, 1974. Although Chris suffered periods of ill health from time to time his sudden passing came as a great shock to all his friends. Chris was a keen and active amateur, mostly on the six and two metre nets, but with long-term plans for a full licence and a broadening of activities. He invariably had a piece of gear of some kind under construction on the bench. Only a few weeks prior to his death he had attended the Gosford field day and won the six metre talk-in fox hunt. He and his fiance, Joy, had planned to marry in June this year.

To his parents, and to Joy, we extend our deepest sympathy.

Gold Coast Radio Club

A new site is being acquired for the Gold Coast FM repeater which will have the new call sign VK4WIG. It may be in operation by the time these notes are read.

On 22nd December, 1973, several contacts on 146MHz FM are reported to have been made with VK3, VK5 and VK7 stations by Art Burton, VK4FE and Mike Adams, VK4ZDA. Art, VK4FE has also had several interstate contacts using 144.1MHz SSB, including one with VK5-DK.

It is also reported that Mike, VK4ZDA is proto-typing solid state SSB equipment for the 144MHz band. If sufficient interest is shown it could become a club project. If interested in this or other activities write to the secretary, PO Box 588, Southport, Qld 4213.

Westlakes Radio Club

A straight to the point note regarding "pirates" in the amateur 11 metre band and adjacent frequencies in the South Newcastle and other areas appeared in the March issue of the Westlakes Radio Club newsletter.

"Unlicensed operation has never been, and will never be, condoned by this club. Beware then of those who claim that they are club members when you know very well that they are pirates.

"There is a perfectly legitimate way to become a radio amateur and there are also perfectly legitimate ways to locate and punish those who operate illegally. All this fancy name jazz — 'Hotel Bravo,' Southern Cross' and such like mean only one thing; the person using them is a pirate."

It is also suggested that if all clubs and divisions of the WIA moved together on the menace, this illegal activity, too often thought by the general public to be amateur radio, could be checked.

The Westlakes Radio Club annual general meeting was held on Friday evening, 22nd February, 1974. The special guest was Kevin Watson, VK2BLW, NSW state supervisor of the WIA Youth Radio Club Scheme. Kevin also acted as chairman for the election of officers. Officers appointed were: Director — Joe Waugh, VK2IQ; Co-directors — Keith Howard, VK2AKZ and Brian Jones, VK2ZKF; Secretary — Eric Brockbank, VK2ZOP; Treasurer — Max Maclachlan. In addition there were appointments to supervise various aspects of the club's activities and a committee of six. Two new positions were created; education officer and social co-ordinator.

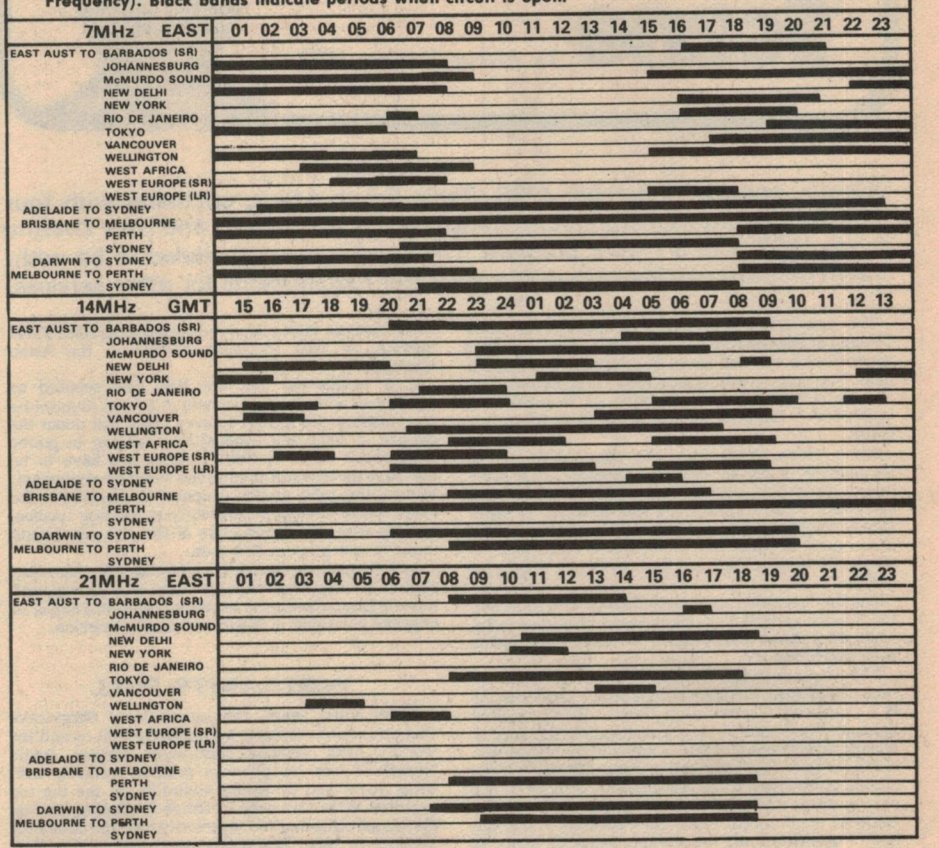
Construction of the new club premises is progressing rapidly. Water and power have been connected and a start has been made on stage II. This includes an entrance hall, office, and toilet facilities. The new premises are in York Street, Teralba.

As soon as the building is ready the YRCS classes and other activities will be transferred from Ranclaud Street, Booragul.

Full details of the club's activities from the secretary, Eric Brockbank, VK2ZOP, PO Box 1, Teralba, NSW 2284.

IONOSPHERIC PREDICTIONS FOR MAY

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Commonwealth Bureau of Meteorology. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open. 5.74



Maitland Radio Club

The Maitland Radio Club annual general meeting was held at the club rooms on Saturday night, 9th March, 1974. Mayor of Maitland, Ald Noel Unicomb, chaired the meeting. Presenting the annual report, Kevin Watson, VK2BLW, said the club had made tremendous headway during the past year. A record membership of 167 was attained and the total attendances at all functions was an all-time high of 4488 persons.

Sixteen examinations were conducted for WIA Youth Radio Club Scheme certificates, for which 56 members qualified. One member qualified for the YRCS radio instructor's certificate and two gained their AOCP at the PMG's Department examinations.

Kevin Watson, founder and life member of the Club, was re-elected unopposed for his eighth consecutive term as president.

A display to demonstrate amateur radio and club activities was given at a fete held at the Dungog High School on Thursday night, 14th March. This created a lot of interest among students and residents.

Room to room telephone communication is now possible at the club, an automatic telephone exchange given to the club by General Electric Company Telecommunications has been installed under the supervision of club member Garry Watson.

For information on the MRC write to the secretary, Box 59, East Maitland, NSW 2323, or telephone Maitland 37 2282.

WIA Hunter Branch

On Friday, April 5th, the lecture at the Hunter Branch of the Wireless Institute was given by Mr Jim Rowe, the Editor of "Electronics Australia." The lecture was at the Newcastle Technical College, and Mr Rowe's topic was "Some Interesting Concepts and Applications of Digital Logic." The audience showed considerable interest in some of the points raised during the lecture, and from the questions asked afterwards it became apparent that many radio amateurs in the Hunter Valley are keenly interesting in digital electronics and its applications.

On the morning of Saturday 6th, while still in Newcastle, Jim Rowe was taken on a guided tour of the studio facilities at television station NBN-3 by the Assistant Chief Engineer Rodney Prout, VK2CN / T. The station is well advanced in converting to colour, and Rodney was able to show Jim their impressive array of colour videotape machines and telecine machines, together with their new master control room and newly outfitted colour OB van.

Before leaving for Sydney, Jim Rowe drove across to East Maitland, where he had been invited to revisit the Maitland Radio Club. After a very pleasant lunch with club president Kevin Watson, VK2BLW and his wife Margaret, Jim was able to look over the club premises with them and make a comparison with the position at his last visit, about two years ago. The contrast was most dramatic, and Jim congratulated Kevin on the club's very impressive progress as an integrated community youth centre.

SO YOU WANT TO BE A RADIO AMATEUR?

To achieve this aim, why not undertake one of the Courses conducted by the Wireless Institute of Australia? Established in 1910 to further the interests of Amateur Radio, the Institute is well qualified to assist you to your goal. Correspondence Courses are available at any time. Personal classes commence in February each year.

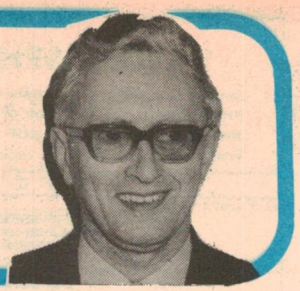
For further information write to:

THE COURSE SUPERVISOR, W.I.A.

14 ATCHISON STREET, CROWS NEST, N.S.W. 2065

Shortwave Scene

by Arthur Cushen, MBE



Officially opened in October 1965, Radio South Africa, operating with four 250kW transmitters, commenced transmissions to Australia and New Zealand in late 1967 with a 1 hour program. This service was scheduled to be withdrawn on Saturday May 4 due to transmitter requirements for other services.

The two daily transmissions, beamed to New Zealand at 0800GMT and to Australia at 0900GMT, have never been a success due to the difficult propagation path. The polar transmission area does not enable a regular service due to difficulties in transmission, coupled with the station's use of the high frequency bands.

From observations over the past seven years, frequencies in the 13, 16 and 19 metre bands have mainly been used, and generally 21545kHz has been successful when transmission was possible. It could only be expected that this service would be cancelled as, in most months, the transmission could only be received less than 1 day in 5 and then often of inferior quality.

The Dutch and German transmissions to Europe and the French service to Canada were also suspended, while the English transmission to North America has been shortened.

The transmitting facilities are located at Bloemendal near Johannesburg, and are known as the H.F. Verwoerd Transmitting Centre. Having visited these facilities, one is sure that it is not the lack of modern equipment that has resulted in the suspension of the service, but rather the fact that South Africa is closing its medium-wave services and is to serve the area on short-wave and FM. The popularity of Radio South Africa in recent years has increased, and in the last "Popularity Poll" the station rose to 9th place. In the future, listeners will hear South Africa only in programs beamed to Europe, North America and Africa.

THAI WEATHER STATION

The Bangkok Meteorological Station which broadcasts weather and shipping on 7863kHz and closes at 1330GMT was reported in last month's issue.

Steven Greenyer of Invercargill, NZ, has verified these broadcasts and in a letter they state, "The station is operated by the Telecommunications Division of the Bangkok Meteorological Department. Because of financial difficulties, the staff borrow records from their friends to play on the air. They also record songs from other radio stations on a cassette recorder at home, then bring the cassettes into work to play them. This results in some of the songs being cut at the beginning or end to remove unwanted advertising. The weather forecast is given in English at 15 minutes past the hour from 0015 to 1315 GMT except for 0215, 0515, and 1215. It is of 2 or 3 minutes duration. Sign-off is at 1330GMT. The address is: Meteorological Department, Sukumvit Road, Bangkok, Thailand."

BBC MALAYSIAN RELAY

The Far East Relay station of the BBC, located at Johore Bahru, is reported to be closing shortly due to the expiry of the 25 year lease which has enabled the BBC to use this relay point since the end of World War 2. Listeners in Australia and New Zealand, as well as the Far East, depend heavily on BBC Tabrau for re-broadcasting BBC programs from London. In particular, during our winter months direct reception from London is not possible after dark, and this relay station plays a vital role in re-broadcasting BBC World Service, as well as those carried in the Asian languages.

It is understood that the BBC has secured an agreement with the Government of Brunei to move its transmitting site to that country. This will mean the closure of some ten transmitters ranging in power from 250kW down to 100kW. These will have to be moved to the new site or replaced with new equipment. Without this relay station, listeners in this part of the world would have great difficulty in hearing London, and the expected introduction of the new site should improve reception in this area.

At the same time the BBC is planning a further relay station in conjunction with the Voice of Germany, and this one is to be located in the West Indies on Antigua to improve reception in North and South America.

POPULARITY POLL

Every three years, the International Short-wave Club in London conducts a Popularity Poll to find the world's most popular short-wave station. Radio Nederland took top place, a position formerly held three years ago by Radio Australia. In the top ten positions there was only a change in placing, and no station gained a marked superiority over the others. Of interest to New Zealanders was that Radio New Zealand was in 43rd place. Considering New Zealand has no International Service, this is a good ranking for such a low-powered service. The top ten positions, with their 1971 placings in brackets, are as follows:

1 Radio Nederland (3)
2 B.B.C. London (2)
3 Voice of America (4)
4 Radio Australia (1)
5 Voice of Germany (5)
6 Radio Canada (7)
7 Radio RSA (8)
8 Radio Sweden (12)
9 Radio Japan (6)
10 Swiss Broadcasting Corp. (11)

SUNSPOT COUNT DECLINES

The monthly sunspot count has shown a gradual drop over its 11 year cycle, and is fast approaching its lowest point. The count has a major influence on short-wave reception as the lower short-wave frequencies are more active during low sunspot activity, and readers will notice little activity on the 11 and 13 metre bands.

The latest report from the Zurich observatory shows that in February there were days when there was no sunspot activity. The present count, together with predictions for the next few months, are as follows:

March 23	May 21	July 18
April 22	June 19	August 17

THE VOICE OF CHILE

The International Service of the Voice of Chile is now being well received on two frequencies. A service commencing at 0900GMT is observed on 6195kHz with news bulletins and announcements in several languages. Another frequency, 15150kHz, is in operation from 2045-0500GMT, and our reception has included an English news bulletin at 0217GMT. The station has verified reports concerning their broadcasts, and this was received by airmail in the form of a post card with hand written details including the date, time, and frequency of the reception. The verification signer is: Jefe Dpto. Lecnico, Radio Nacional De Chile, Casilla 244V, Santiago, Chile.

TWR TRANSMITTER FOR GUAM

According to Colin Miller of Johannesburg, Trans World Radio are to build a relay station on Guam in the Central Pacific. This new relay base will broadcast Gospel programs to Australia and East Asia. Transmitter power will be 250kW and construction is expected to commence later this year after the Swaziland relay station has been completed by TWR engineers. Trans World Radio already has a relay base on Bonaire in the Caribbean. The new base will give coverage of the Asian area, while the Swaziland station should provide an adequate service for Africa.

MEDIUM-WAVE NEWS

PAPUA NEW GUINEA: The last of the projected six medium-wave stations for Papua New Guinea is now in operation. This is 9WK Wewak which operates on 1520kHz and closes at 1400GMT. This station was one of five put into operation by the Australian Broadcasting Commission before Papua New Guinea became independent.

HAWAII: Radio KHVH Honolulu, which is heard on 1040kHz around 1600GMT, is planning to move to 1010kHz and increase power from 5kW to 10kW. The reason for this is that the station feels it can serve the outer islands and also move further down the dial away from the other Honolulu station KIOE, which operates on 1080kHz. An interesting item from Hawaii is that the Filipino session, formerly carried on KISA on 1540kHz, can now be heard from KORL on 650kHz at 1500GMT.

AUSTRALIA: According to the Australian Broadcasting Control Board, call signs have now been allocated to the projected ABC repeater stations. These stations are:

720kHz,	3MT Omeo, Vic.
760	6KW Kununurra, WA.
990	8GO Gove, NT.
1040	4WP Weipa, Qld.
1160	7FG Fingal, Tas.
1190	6XM Exmouth, WA.
1570	7SH St. Helens, Tas.
1570	2WA Wilcannia, NSW.

The new commercial station for Canberra, which is to operate on 1210kHz, has not been assigned a call. The most recent frequency change concerns 4GY Gympie, which has moved from 1350kHz to 600kHz.

PHILIPPINES: There have been several changes in the Philippines, and as well as many new stations appearing several have been closed down by Government decree. These mainly include stations operated by the Manila Times which had several stations in Manila, as well as in other cities. According to Sunspot, the magazine of the Finland DX Club, those which have closed are: DZMM (1000), DZWS (1070), DXMT (1100), DXRH (1300), DXTM (1380), DZBU (1460kHz).

LISTENING BRIEFS

EUROPE

AUSTRIA: In the near future, the DX-programs on ORF will be broadcast in English instead of German on Sunday at 0915 and 2000GMT.

INTERNATIONAL WATERS: According to Sweden Calling DXers, the Dutch Government has signed the Strasbourg-treaty of 1965, which means that the three pirate ships off the Dutch coast have to leave the air in the near future. These are Radio Veronica, Radio Nordsee International and Mi Amigo. Radio Nordsee is well received on 6210kHz around 0700GMT and again at 1900GMT with programs mainly in Dutch, but with some English announcements. Radio Veronica is the longest established offshore broadcasting station, and has been operating off the coast of Holland on medium-wave for many years. The closure of these stations will mean the end to an era of pirate radio in Europe.

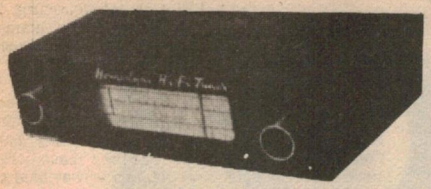
ASIA

NEPAL: Radio Nepal at Katmandu has been heard on a new frequency of 3425kHz after changing from 5000kHz. Reception has been best at 1435-1520GMT during their External Service in English. The former frequency of 5000kHz always suffered interference from WWV, but the new frequency is free from interference and according to John Mainland from Wellington, NZ, is giving good reception.

SOUTH YEMEN: The Aden Station in South Yemen is now reported to have a transmitter power of 100kW, and has been observed on 11770kHz with Arabic transmissions. According to John Mainland, the station offers good reception when closing at 1700GMT. For many years Aden has been heard on 5060kHz when the power was 7.5kW.

MONGOLIA: According to the ARDXC, the latest schedule of Radio Ulan Bator is 1220-1250GMT on 17780 and 17820kHz and 2200-2230GMT on 11810 and 11860kHz. This information comes from verifications received by Robert Hanner and Geoff Cosier.

Further details on other stations, and information on what is being heard by readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT, add 8 hours for WAST 10 hours for EAST and 12 hours for NZT.



HOMODYNE TUNER KITSET

Discrete component version from November W.A. **$24.00**

MUSICOLOUR: The Mk 2 model from Electronics Australia. 3 channel, 6 amps max per channel. Self-contained with its own driver amp. Requires only a small signal voltage to operate it. Kit contains printed circuit board, transformers & components, but no plugs, sockets, or metalwork. **ONLY $47.40**

Philips Discrete Component Preamp: All the components, including print circuit board and anodised front panel for a really high quality low noise stereo preamp. The noise ratio on magnetic input is better than 90db. Here are the specs. . . .

INPUT	SENSI TIVITY	INPUT Z	FREQ RESPONSE	UNWEIGHTED S / N RATIO
Crystal pickup	300mv	1m ohm	10hz-35khz	>80db
Magnetic PU	4mv	47k ohm	10hz-45khz	>90db
Radio tuner	150mv	500k ohm	10hz-35khz	>80db
Tape recorder	300mv	500k ohm	10hz-45khz	>85db
Mag mike	3.5mv	22k ohm	10hz-65khz	>80db

COMPLETE STEREO PREAMP KIT FOR ONLY **$19.85.**

VHF KITSET: One transistor, super-regenerative, receives Police, taxis, aircraft, etc. Pictorial instructions supplied. Works through an ordinary transistor radio without connecting wires. Heap big magic, eh! **$5.40**

SILICON POWER TRANSISTORS: Types BD433 / 434 Philips brand. Will supply 8 watts RMS from 12 volts. Suitable for car radios, modulators, etc. Supplied with suitable circuit. **$2.50**

L.E.D.: Light emitting diode. Miniature point source type. Hewlett Packard part 5082-4487. Operating data supplied. Runs off 1.6 volts. **47c** each or 5 for **$2.00**

ITEMS REQUIRED.....

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I enclose cheque / money order, including 50 cents extra to cover postage.
We regret that due to currency regulations we cannot accept personal cheques.

NAME:.....

ADDRESS:.....

Send this coupon to

WELLINGTON KIT PARTS LTD ALL RADIO COMPONENTS

P.O. BOX 27 037, Wellington, New Zealand.

MONEY BACK IF NOT COMPLETELY SATISFIED

DEAR KIT PARTS — PLEASE RUSH MY ORDER — THIS BATH IS GETTING COLD!

STOCKTAKING BARGAINS

Bridge rectifier BY122 0.8 amp 50 volt 3 for **$1.00**

Preset wafer pots 10k ohms 10 for **$1.00**

Electrolytic. Can type 50 + 50 ufd 400 volt 3 for **$1.00**

Electrolytic. Can type voltage doubler 100ufd 200 volts 2 for **$1.00**

Electrolytic. Insulated blue tag type 25ufd 450 volt 5 for **$1.00**

Electrolytic. Pigtail type 32ufd 350 volt 5 for **$1.00**

Electrolytic P.C. type 400ufd 10 volt 10 for **$1.00**

Electrolytic P. C. type 10ufd 300 volt 6 for **$1.00**

Ducon polyster PC capacitor 0.1ufd 400 volt 10 for **70c**

---

25 WATT STEREO POWER AMP

This kit utilises the Sanken hybrid power amps and is supplied complete with surrounding components. It matches the above Philips preamp but can be driven off any quality preamp. Power supply not included. **$44.00**

— VALVES —

5U4GB	$1.35
6B7	$1.25
EZ80	.80
6DT6A	$1.20
80	$2.00
PCF82	$1.65
PCF86	$1.35
6EM5	$1.50
1B3GT	$1.35
PL36	$1.20
PL84	$1.20
ECH84	$1.80
PCC88	$2.40
EZ81	.80
EAA91	.75
5AS4	$1.35
35L6GT	$2.80
12BA6	$1.50
12BY7	$1.60

MODEL RH-20 $20.00 Packing & Postage $1.00.

20,000 Ohms per Volt DC.
10,000 Ohms per Volt AC.
Specifications:
DC Volts: 0.25, 2.5, 10, 50, 250, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current, 50uA, 25mA, 250mA.
Resistance: 7K, 700K, 7M.
Decibels: –10, +22 (at AC / 10V) +20, +36 (at AC / 50V). Upper frequency limit 7KHZ.
Batteries: Two 1.5V dry cells.
Complete with test leads

MODEL RH-80 $22.00 Packing & Postage $1.00

20,000 Ohms per volt DC.
10,000 Ohms per volt AC.
Specifications:
DC Volts: 0.5, 2.5, 10, 50, 250, 500, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: 50uA, 5mA, 50mA, 500mA.
Resistance: 5K, 50K, 500K, 5M.
Decibels: –10dB + 62dB.
Accuracy: DC 3pc.
AC 4 per cent (of full scale).
Batteries: Two 1.5V dry cells, size AA, "Eveready" 915.

4-SPEED RECORD UNIT

"Ambassador" 4 speed 16, 33, 45 & 78 rpm stereo phono unit, complete with Ronette pickup. Stereo ceramic cartridge and stylus for LP and 78 records.
Packed ready to mount with screws and template for installation.

Instructions for connecting to amplifier or radiogram. 240V AC mains operated.

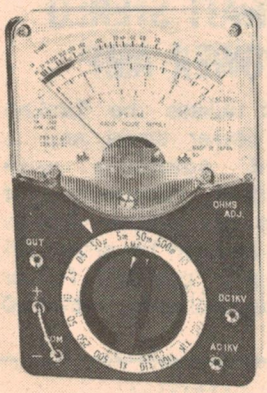
Posted NSW $16.50. Posted Interstate $17.00.

Reduced from $25.00. Special Offer.

Order now, limited stocks.

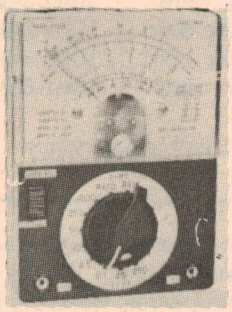
NEW RH (Radio House) RANGE OF MULTIMETERS

MODEL RH-60 $29.00 Packing & Postage $1.00



50,000 Ohms per Volt DC.
10,000 Ohms per Volt AC.
Specifications:
DC Volts: 0.25, 2.5, 10, 50, 250, 500, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: 25uA, 5mA, 50mA, 500mA
Resistance: 10K, 100K, 1M, 10M.
Decibels: –10 +62dB.
Accuracy: DC ±3 p.c., AC ±4 p.c. (of full scale).
Batteries: Two 1.5V dry cells. Overload protected.

"HANDYMAN" RH150 $14.75

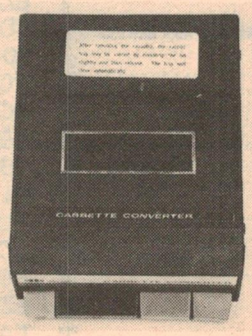


CHECKED PACKED & POSTED $15.50
Pocket-size 3¼" x 4½" x 1¼". Instruction sheet and circuit.

SPECIFICATIONS:
DC Volts: 2.5, 10, 50, 250, 1000. 10,000 ohms per volt
AC Volts: 10, 50, 250, 500, 1000.
DC Current: .1, 25, 250mA.
Resistance: 20K and 2M.
Decibels: –20dB, +62dB, 0.7KHz.
Capacitance: .0001, 01, .0025, 25uF

NEW MODEL NA – 100 CASSETTE CONVERTER

PRICE: **$35.00** Pack & Post $1.00.
Play your cassette tapes through your car Radio and speaker and save **$30.00** to **$40.00**
SIZE 6" x 4½" x 2⅛"
Complete with fittings and instructions to install in any car which has a radio fitted. Radio can also be operated when required. This model reproduces the excellence of music from a cassette through the AM Car radio. Operation is extremely simple.



WORLD RANGE SOLID STATE DELUXE RADIO "LONGINES SYMPNONETTE"

19 TRANSISTORS – 9 Diodes – 500 MW output.
SIZE 11" x 13" x 5".

FEATURES:–
1. Tuning knob
2. Fine tuning knob
3. On-Off push Switch
4. Volume Control
5. Tone Control
6. Squelch Control
7. Band selector knob
8. Time zone
9. Telescopic antenna
10. Dial light
11. AC / DC selector
12. Extension Antenna Jack
13. Earphone Jack

This new Solid State Radio is all-band, all transistor portable designed for super sensitive reception of Amplitude Modulation (AM) Marine Band (MB) International Short Wave (SW1, SW2) Frequency Modulation (FM) Public Service Band LOW (PB), AIRCRAFT (VHF1) High Public Service Band (VHF2) and Weather Band (WB).
These Bands will provide you with many hours of entertainment and excitement. This radio is also equipped for house electricity (240 AC) as well as by batteries (4 "D" cells).
PRICE:– **$135.00** pack & post $1.50.

RADIO HOUSE PTY. LTD.

306-308 PITT STREET 61-3832 26-2817 760 GEORGE STREET SYDNEY. 211-0171

INFORMATION CENTRE

GALENA CRYSTALS: In your December issue on page 125, P. J. Hawthorn, Vic asked about galena crystals. Being an avid experimenter in my youth I found that workable crystals could be made by melting lead and dropping in a lump of sulphqur. I also found that the old type blue razor blade and a safety pin made a workable detector. (V.M.E., Mount Morgan, Qld.)

Thank you for your contribution, V.M.E. We are pringing your recipe so that those interested can conduct their own experiments.

S METER: I am a beginner in the field of electronics, and have adopted your magazine as a general text for information. You've done a good job on the magazine. I have two questions: An S Meter, as I understand it, is a frequency meter. What other meters can be used as frequency meters? What type of aerial would best be suited to a six-band short-wave receiver? (D.G., Calala, NSW).

First of all, D.G., thanks for the kind remarks. Now, down to the nitty gritty. An S Meter is not a frequency meter, it is merely a signal strength meter. It can in no way determine frequency. To measure frequency, one must have a meter designed to do just that. Regarding the aerial, there is no hard and fast rule. However, you might remember an old rule of thumb — "as high and as long as possible" but bear in mind that it must be kept clear of power lines, etc. We described an aerial some time ago which you may care to examine — this was the "Twin Doublet" which is intended mainly for short-wave reception. It appeared in an article called "Beating the Noise Problem" in the January 1968 issue (File No 2 AE 21).

COMPONENTS: In the issue for January, 1974, you described the Low Cost Homodyne Tuner. I have tried to buy a complete kit of parts but everywhere I was told that the IC type LM1351 has not been in stock for months. When I told them that it was for a project from Electronics Australia, I was told in one shop that you were famous for making projects impossible to build because you use parts which are unavailable anywhere. Is it true? Must I give up the construction of this project and throw all the parts I have already bought into the rubbish bin? Perhaps you may be able to tell me where I can get an LM1351 IC. (G.S., Glebe, NSW.)

The current and widespread difficulties associated with component availability have already been aired at some length and this is something with which we all have to contend. However, we can stoutly deny that we describe projects for which it is impossible to obtain parts. In point of fact, considerable research is done regarding the availability of any special components before a project is embarked upon. As you have not been specific regarding difficulty in obtaining components other than the IC, we are unable to comment further here. We have checked with NS Electronics regarding the LM1351 IC and they assure us that there are ample stocks in the country. Sydney stockists John Carr Pty Ltd have ordered stocks at the time of writing and they should have ample supplies by the time this appears in print. It is also possible that Pre-Pak Electronics may have them in stock.

STEREO AMPLIFIER: I have been getting your magazine now for 3 years and I think it is the best electronics magazine available. In your October 1972 issue you published a circuit for a mono 21 watt amplifier. I was wondering if it would be possible to change it into a stereo amplifier as shown in the enclosed diagram. If not, could you please tell me how to?

Also could you please tell me how to measure the wattage from an amplifier output? (W.R.)

Thank you for your kind comments about E.A. From your circuit, it appears that you have not fully grasped the concept of a stereo amplifier, as opposed to a mono amplifier. You show a single preamplifier feeding two power amplifiers via balance and volume controls. This will not produce stereo, as only a single channel source is being used. To provide stereo, two preamplifiers must be used in conjunction with two signal sources, such as the dual outputs from a stereo cartridge.

These are connected as two separate mono amplifiers, with the balance control connected between the outputs of the preamplifiers.

The usual method of measuring the power output from an amplifier is to measure the voltage developed across a resistive load, at the onset of clipping, when the amplifier is fed with a 1kHz signal. The resistive load should equal the nominal speaker impedance. The power output is then given by the square of the RMS voltage divided by the resistance.

POWER BOARDS: Have you ever printed information on electric power boards, or do you intend doing so? (R.S. Armidale, NSW).

Unfortunately we are not sure what you mean by electric power boards. If you care to write again and give us more details we may be able to help.

RADIO CONTROL: My father is interested in electronics, and I am keen on model aircraft building, but we are having trouble combining the two. We have been buying Electronics Australia for six years, and from time to time various people have written in asking for circuits. I know at least three people who would have built radio control gear if up to date circuits were available to suit the local market. Surely there would be enough people interested in this subject for you to publish serious projects? (C.I.R., Mt Waverley, Vic.)

We agree that there is probably sufficient interest in the subject to justify our describing projects, C.I.R., but radio control projects are rather specialised and require both special components and also a solid background of experience. They also tend to require testing in the field, which can prove to be both time-consuming and expensive. But we will certainly look into the matter to see if there is anything positive which we can do.

FREQUENCY COUNTER: I am very interested in building the Digital Frequency Counter described in the December 1973 issue. However I cannot understand some of the abbreviations shown on the wiring diagram on page 41: those marked cal o/p, carry to o/f option, T to o/f option, and so on. Also down near the range switch there is the abbreviation "TB IN." What do these all mean? Apart from this, the project seems an excellent one. Keep up the good work. (K. M., Lyndock, SA.)

All of those which include reference to "o/f" are intended to indicate the connection points if the optional overflow flip-flop is added, K. M. If you do not intend to fit this option, simply ignore them. We hope to publish wiring details of the overflow option shortly, to clear up any possible confusion. The "cal o/p" connection is that which connects to the calibration signal output socket, while the unmarked connection next to it is the one which connects to the desired calibration signal along the bottom of the board. The "TB IN" connection is the clock or "C" input of the first cycling flip-flop of IC3, which connects to the rotor of S1c. We hope these clear up your confusion.

APOLOGY

Knowing that our April issue was being published in April 1st this year, Dick Smith Wholesale Pty Ltd prepared their advertisement on page 23 of that issue as a practical joke, to generate some good-natured fun. However Murphy's Law operated, as it always does when this will cause the most embarrassment. Despite our joint efforts, a printing error made the joke much less obvious than it should have been. We apologise for any inconvenience this caused.

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DIGITAL ELECTRONICS

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As a service to readers "Electronics Australia" is able to offer: (1) Project reprints, metal work dyelines, photographs, printed wiring patterns and other filed material to do with constructional projects and (2). A strictly limited degree of assistance by mail or through the columns of the magazine. Details are set out below:

PROJECT REPRINTS: These cost 80c per issue-reprint. Thus, a project spread over three issues will cost $2.40. Reprints are available for all projects, but no material can be supplied additional to that already published. Reprints can be supplied more speedily if they are positively identified and not accompanied by technical queries. Material not on file can normally be supplied in photostat form at 40c per page.

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REPLIES BY POST: These are provided to assist readers encountering problems in the construction of our projects published within the last two years. Note, particularly, that we cannot provide lengthy answers, or undertake special research or modifications to basic designs. Charge: 80c. Inclusion of an additional fee does not entitle correspondents to special consideration.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee and may be answered in the magazine at the discretion of the Editor. Technical queries will not be answered by interview or telephone.

COMMERCIAL EQUIPMENT: "Electronics Australia" does not maintain a directory of commercial equipment, or circuit files of commercial or ex-disposals equipment etc. We are therefore not in a position to comment on any aspect of such equipment.

COMPONENTS: "Electronics Australia" does not deal in electronic components. Prices, specifications, etc should be sought from appropriate advertisers or agents.

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POSTAGE & PACKING: All charges shown include postage and packing, unless otherwise specified.

ADDRESS: All requests for data and information should be directed to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield 2014.

A.C.E. RADIO

AMPLIFICATION · COMMUNICATION · ELECTRONICS

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Mounting base with perspex cover **$23.80.**

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Deluxe model with 12in turntable, Cueing device, ceramic cartridge, diamond stylus **$46.50**
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The latter two record changers can be supplied with magnetic cartridge and diamond stylus at $10 extra.

REVERBERATION UNITS

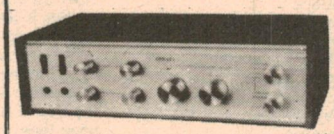
MODEL	DELUXE	STANDARD
Suggested Operating Level		
Current	2mA	2mA
Volts at 1000 Hz	3V	4V
Input Power	6mW	8mW
Output Power	2.7mW	2.2mW
Freq. Response	60-5500 Hz	60-3000Hz
Decay Time	2 secs.	1.5 secs.
	$19.00	$7.95

COMMUNICATION RECEIVERS

LATEST MODELS

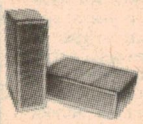
Now available at greatly reduced prices. TR10 9R59DS. 550 KHz to 30 MHz. 4 bands. AM. SSB. CW. BFO. **$148.50.** Realistic. DX 150B. Solid state **$182.00.** Send SAE for full tech. Details.

SONATA NS-1600D



All silicon solid-state Hi-Fi Stereo Amplifier. 10 watts RMS per channel. Each channel has separate Bass Treble controls. Inputs for magnetic or ceramic cartridge, crystal mic, radio, tape — tape out, stereo headphones, 8-16 ohms. Instruction booklet, circuit supplied. Timber cabinet. Dimensions 14½ x 8" x 4...
$67.50 plus freight **$2.50.**

NEW IMPORTED SPEAKER SYSTEM



Beautiful walnut cabinets 37 x 12 x 23 mm. The system is excellent quality and ideal to use as main speaker or extension with your stereo, cassette recorder, etc. **$12.95** each or **$23.00** per pair. P&P $1.00 each.

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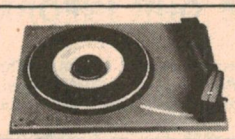
240V AC — 4 speeds, ceramic cartridge, separate motor, 7in turntable, pickup arm and rest. Post 50c **$7.90**



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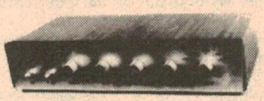
Three speed turntable with "Sonatone" ceramic pick-up mounted on grey metal base plate with automatic stop.
$15.50. Post and packing NSW — **$1.00;** Interstate — **$1.50.**

PLAYMASTER 136 STEREO AMPLIFIER



As per Dec 72 E/A
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P.C. boards **$8.00**

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1.6 cft complete	**$58.00 ea.**
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3TC	**$3.40 ea.**
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8-16 OHMS	30-16,000Hz
6WR MK5 12W RMS	**$9.90**
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Pioneer 15" 20-7500 Hz Res 45 Hz 30 WATTS RMS **$33.00**
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Indicate imp. required with order, 8 or 15 ohms.

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4 or 8 OHMS. Suitable for radio cassette or cartridge **$7.75** each, **$12.50** pair. P&P 75c.

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240V AC 30 watts, lightweight 2½oz, heating time 1.8 mins. **$7.75**

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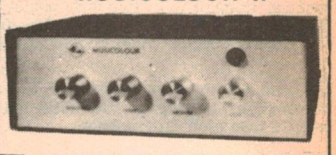

Operates in conjunction with your home Hi Fi or P.A. System, and as the music plays, different coloured lights respond. The Musicolour II has three channels. The max. number of coloured lights is not to exceed 1500 watts per channel. As per EA Dec '71, Jan '72. Complete kit of parts **$49.50**
Fully constructed **$59.50**
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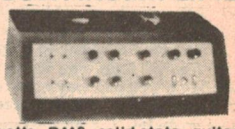
50 WATT SOLID STATE GUITAR AMPLIFIER



50 watts RMS solid-state guitar amplifier. PM125 4 inputs, 2 channel with separate volume, bass and treble controls; speed and intensity controls for vibrato. Remote foot switch with plug and lead. Black vynex carry cabinet. Fully constructed and ready for operation off 240VAC **$125.50.**

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5"	33	4½	105- 6500 Hz	**$3.00**
5" TWIN	33	4½	105-14000 Hz	**$3.45**
6" x 4"	33	5½	105- 6500 Hz	**$3.60**
6" x 4"	3.4.15	5½	105-7000 Hz	$3.60
6" x 4" TWIN	3.5	5½	105-14000 Hz	**$3.80**
6"	2.7	6	80- 6500 Hz	**$4.65**
6"	8	6	80- 6500 Hz	**$5.55**
6" TWIN	8	7	35-13000 Hz	**$6.55**
6" TWIN	15	7	35-13000 Hz	**$6.55**
7" x 5"	27	5½	105-10000 Hz	**$4.00**
8"	2	8	45-9000 Hz	$5.50
8" TWIN	8	11	30-14000 Hz	**$7.95**
8" TWIN	27	11	30-14000 Hz	**$6.75**
8" TWIN	8.15	9	35-13000 Hz	**$7.45**
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RFGD

Electrolube Contact Cleaning Strips are manufactured from specially developed card impregnated with an Electrolube Contact Lubricant.
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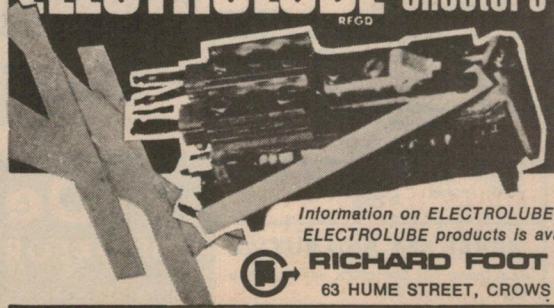

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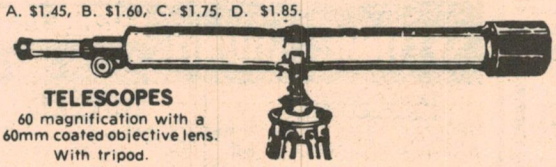

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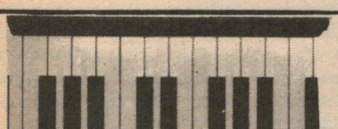

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Monitor from p94.

the slug in the coil for minimum indication on the CRO.

Now connect the CRO to the collector of the video amplifier, TR1. Make sure you do not come into contact with the detector, if the unit is switched on! Set the generator to 1500Hz and advance the contrast control until clipping appears, then back off until the clipping disappears. The output should be about 15V peak-to-peak. With 2300Hz input, the output level should fall to about 1V peak-to-peak.

Adjustment of the sync discriminator calls for a little more care and patience than the foregoing adjustments. Advance the sync level control by about one quarter of its full travel. This may need to be adjusted more closely later on. Connect the CRO to the collector of TR2, and feed in 1200Hz at 100mV from the audio generator. While specific frequencies mentioned so far are quite important as regards accuracy, it is particularly vital to be sure that the 1200Hz is known accurately. Having made this point, we can leave the rest to the reader's own ideas as how best this may be achieved.

Vary the frequency adjust pot to obtain maximum response on the CRO. It will be found to be quite sharp. Reduce the audio input to zero and all indication on the CRO should also disappear. If not, the stage is oscillating and the feedback control should be reset just below the point of oscillation. Do not try to get too close, as this can be a trial of patience and the extra gain and selectivity are not needed anyway. Switch on the audio input and make any slight adjustment to the frequency adjust control. This should be achieved without the stage oscillating of course.

Having taken the adjustments to this point, we now need a video signal to complete the adjustments. A signal may be taken directly off air from say, 14 or perhaps 7MHz, or even one of the VHF bands. In doing this, it is most important that the signal be tuned in "on the nose." Possibly the easiest way to do this is to adjust the receiver on the same transmission, on speech, after which it will be correctly tuned for the picture. If a tape or cassette recorder is available, it can be very helpful to record a signal and this may be used as required, over and over, for adjustment or other purposes. A fellow amateur who is in the position to do so, may be only too pleased to provide you with some signals straight from his camera, etc, which you may record.

Assuming a source of signals, it should be fed into the monitor and it is reasonable to expect a horizontal trace video modulated. The trace should now be centred on the screen with the horizontal shift control. Press the vertical trigger button and the trace should immediately go to the top of the screen and slowly advance towards the bottom of the screen. Now advance the vertical sync level control until the trace goes to the top of the screen when a horizontal pulse appears. Further advance the sync control until the trace goes to the top of the screen and stays there. Set the control midway between these two positions, which should give correct vertical sync.

Now centre the picture vertically with the vertical shift control. The two initial picture centring operatons will have been tentative and the size of the picture should now be considered and adjusted if necessary. The picture should be square and of such a size that not too much of the corners are cut.

The size of the picture is governed both by the natural frequency of each of the sawtooth generators and the deflection amplifiers. The gain of the deflection amplifiers may be adjusted by altering the resistor between the two cathodes. Reducing the resistor value increases the gain and vice versa. Slowing down the sawtooth generator time constant will also reduce the picture size, and vice-versa. The time constant can best be changed by altering one of the two series resistors. If necessary, the horizontal time constant may be changed by altering the 470k resistor, and the vertical by altering the 5.6M resistor.

It is not very likely that there will be any trouble due to component value spreads changing sawtooth generator time constants and causing lack of sync. However if you should be unlucky enough for this to happen, then the appropriate one or both of the resistors just mentioned should be changed accordingly.

Brightness of the trace is controlled by the automatic bias resistor of 39k at the cathode of the CRT. Although it is not likely to need alteration, the brightness can be adjusted by altering the value of this resistor. Do not reduce the value unnecessarily in an attempt to increase brightness. It must be remembered that the afterglow brightness is quite limited and SSTV viewing is normally done in very subdued light.

Considering the simplicity of our monitor, we are pleased with its performance and we hope that our efforts will encourage other amateurs to embark on this fascinating aspect of amateur radio.

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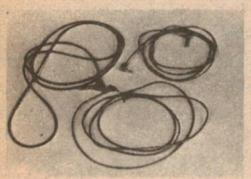

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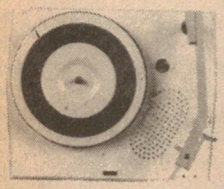

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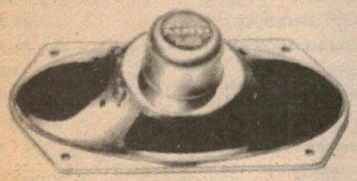

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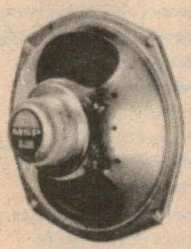
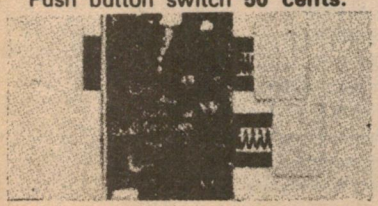
8 / OHM $4.50
15 / OHM $4.50



6½"

Intercom adaptor and lead **$1.**

Push button switch **50 cents.**



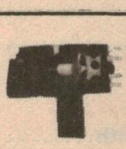
Alligator clips and leads 10 pairs **$1.**

Transistor and driver speaker transformers miniature **$1 a pair.**

Pots 30 mixed values including ganged and concentric **$5.**

Ferrite rods 9 + ½ **50c**

Sato coloured bracket lamps **25 cents**

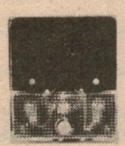


BSR CERAMIC CARTRIDGE STEREO $4.

Morganite and IRC resistors. At least 33 values. Suit transistors, radios, TV etc., **$2.00** per 100. Pack and post. **25c.**
100 mixed condensers, micas, ceramics, tubular. Fresh stock. **$2.00.** Pack and post **25c**

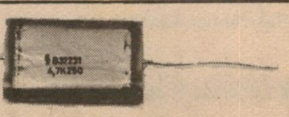
50-ohm POTS ideal for Ext. Speakers. **50c** each.

250 mixed screws. BA, Whit, self-tapper bolts, nuts, etc. **$1** bag plus **25c** post.



Tuning and Balance Indicator Meters **$1.50**

Siemens Super quality 4MFD Cross Over Network Condensors **60 cents**

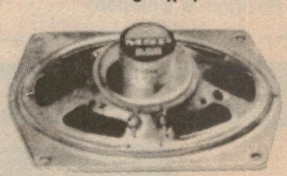


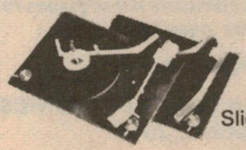
in 8 or 15 ohm **$2.50**

5" x 3"

in 8 or 15 ohm **$3.50**

6" x 4"





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Slightly shop soiled **$15**

PHILIPS GRAMOPHONE MOTOR
6 volts, 4-speed, and pick-up **$7.75.**

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Car Radio Push Button Tuner **$4.50**
Pack & Post 55c Interstate 85c

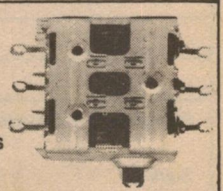
SLIDE SWITCH
3 position **50 cents**

SPEAKERS
5 inch tweeters M.S.P. **$3.50**

SPEAKERS
2¼ inch 15 / ohm **$1.00**

ELECTROLYTIC CAPACITORS
100 MFD 350 WK 400 peak **75 cents**

Tuning Condensors **50 cents**



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If you've been patiently waiting for something special in audio equipment, congratulations.

Because you can now choose from TEAC's newly introduced triple-header.

First, a 4-channel deck with 2-channel automatic reverse playback.

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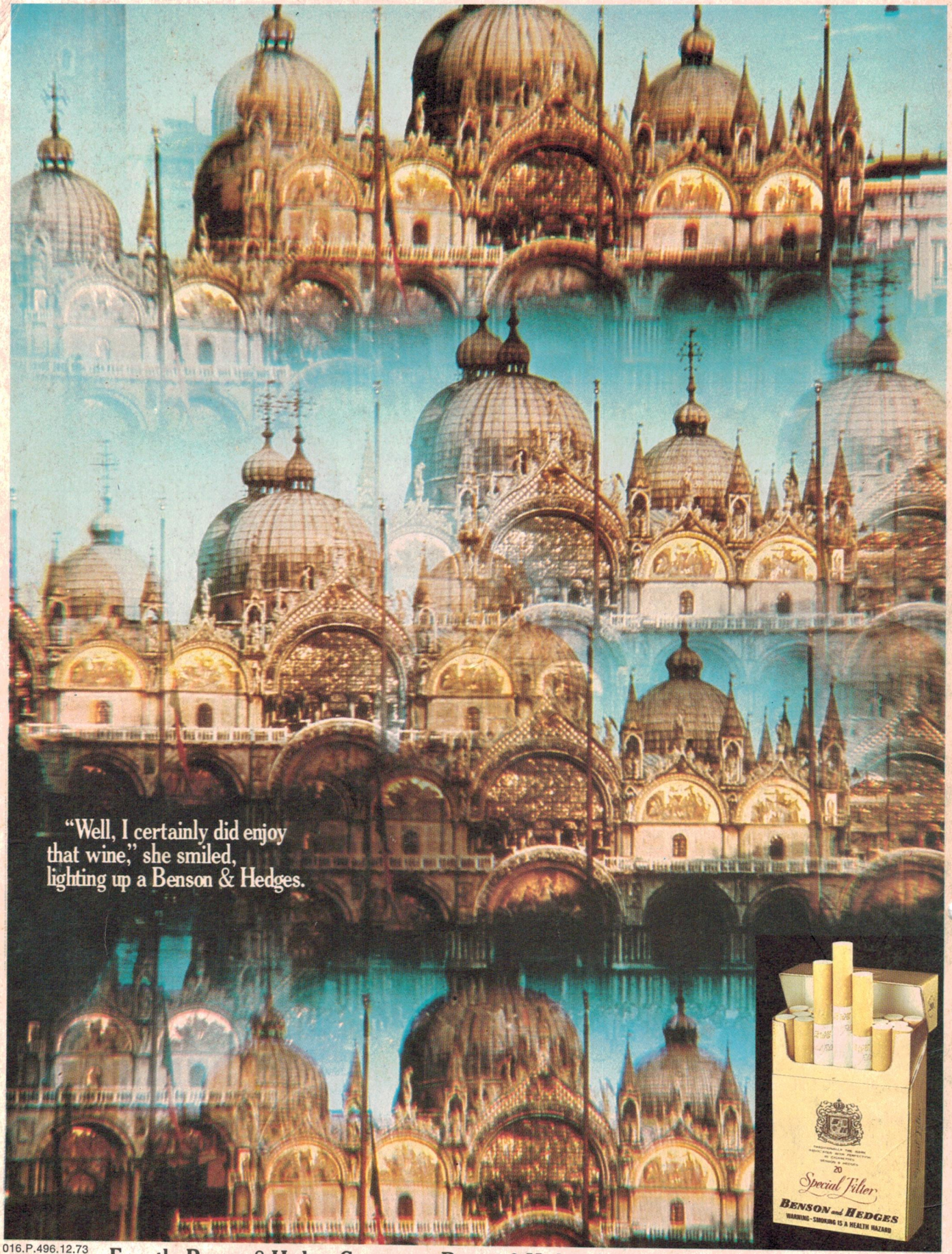

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